ABSTRACT

**Background:** A clear understanding of knowledge, attitudes, and practices (KAP) of tuberculosis (TB) patients is important to encourage patients’ contribution to TB prevention and control. Appropriate knowledge, positive attitude, preventing transmission and early diagnosis of TB are key factors in improving patient outcomes.

**Objective:** This study aimed to investigate the knowledge, attitude, and practices about TB and determine related influencing factors among TB patients.

**Methodology:** A cross-sectional prospective study by using a validated structured tool was conducted among TB patients more than 18 years of age. Descriptive statistics were used to summarize socio-demographic characteristics and TB knowledge, attitude, and practices level. To compare scores of each domain with various demographic factors, the Kruskal Wallis H test was applied.

**Results:** Total participants in the study were 337. Of these, 231 (68.5%) were male and 106 (31.5%) were females with a mean age of 46.5±17.1 years. A significant difference was observed between males and females TB knowledge and practices concerning age. Patients with ≥ 12 years of educational background profoundly have better knowledge.
Keywords: Knowledge; attitude and practices; tuberculosis; Malaysia.

1. INTRODUCTION

Tuberculosis (TB) is a disease of poverty, and financial torment, discrimination, stigma, and prejudice are often faced by the people who suffered from TB [1]. In Malaysia, TB is a significant health problem with the current incidence rate of 92 per 100,000 and the mortality rate of 4.1 per 100,000 population annually [2]. TB incidence rate has reduced worldwide by 2% yearly from 2000 to 2015 after the advent of the End TB strategy [3]. However, this slow rate of decline is not sufficient to control the TB pandemic in the Asian region. In Malaysia, the decrease in TB incidence has stalled from 90 per 100,000 population in 2015 to 92 per 100,000 population in 2019.

TB continues to be 2nd dominant cause of deaths attributable to a single infection disease ranking above HIV. WHO reported 1.4 million deaths among HIV-negative people and an additional 0.35 million deaths from HIV-associated TB in 2019 [1]. Appropriate and in-time TB diagnosis and adequate management facilities can perform a major role in monitoring and controlling TB endemic. To minimize TB incidence and to achieve the target of the End TB Strategy, it is necessary to recognize and manage primary and secondary TB cases along with appropriate awareness among communities.

One of the most important predictors of poor health is a lack of awareness and education followed by insufficient utilization of health care services, low degree of disease screening, maladaptive disease prevention behavior [4,5] and encouragement towards various alternates for their healthcare-seeking [6] which in turns is associated with increased noncompliance of treatment rate [7,8]. Knowledge, attitude, and practices (KAP) work has long been the primary educational treatment strategy for monitoring any disease globally [4]. Literature has shown that KAPs are linked to successful disease control and improvement of an individual's health [9]. This study aimed to evaluate the knowledge, attitude, and practices about TB and determine related influencing factors among TB patients.

2. METHODS

2.1 Study Settings and Population Source

The present study was based on cross-sectional prospective study design and conducted in the respiratory clinic of Hospital Palau Pinang; a public sector tertiary care hospital that covers a large proportion of the Penang state population in Northern Malaysia. Geographically, it occupies a large area and is one of the rapidly growing largest urbanized states with the highest population density of 1,767 million. Hence, researching this sole public sector hospital reflects the true picture of state data. The study was carried out from January to September 2019. All qualifying candidates were ≥18 years of age, literate, and can comprehend Malay or English. Study participants were newly diagnosed TB patients with clinical and radiological evidence. Patients with physical or cognitive impairment that prevent them from being able to answer the questions were excluded. The treatment protocol of TB patients enrolled in this study has been previously reported [10,11].

2.2 Sample Size and Sampling Technique

The required sample size was determined by visualizing the TB prevalence rate in Malaysia which is 92 in 100,000 population. The sample size was calculated, based on the assumption of 95% confidence interval, 5% margin of error, and 10% non-responder rate in our estimate, a total calculated sample was 430. Nevertheless, 337 patients show their consent as a part of this study. Other patients refused to participate because of lack of time, lack of interest, and language barrier. Finally, the data were collected from all the eligible respondents.

2.3 Development of Data Collection Tool

The demographic characteristics and educational background information were collected as part-I of data collection tool followed by the part -II which consist of questionnaire regarding TB knowledge, attitude and practices. The
questionnaire used to collect data for TB knowledge, attitude, and practices was selected and adapted by researcher with consensus of academic experts after an extensive review of available literature related to the topic [12,13] and based on current Malaysian National Tuberculosis Program (NTP) guidelines. This questionnaire has been intended to assess the level of knowledge, attitude, and practices towards TB among patients. The TB knowledge, attitude and practices questionnaire was in English language and translated into the Malay language by linguistic experts and then forward and backward translation was done.

The forward translation was done from the English language to the Malay language to produce a version that was semantically and conceptually as close as to the original version.

Backward translation was done from Malay to the English language by another translator. The translated version was pre-tested among 10 physicians, 10 nurses, and 10 medical academia experts and was finally updated as recommended by experts. All domains of scales displayed good internal consistency. The reliability coefficient of the TB tool was 0.72, which was within the acceptable limits (Cronbach’s α > 0.7). During the pre-test, the tool was evaluated for its clarity, accuracy, reliability, the sensitivity of the subject matter, and cultural acceptability in the region.

Before distributing the data collection tool, written consent for participating in this study was taken from each patient. The questionnaire was self-administered to patients according to their ease of understanding and took at least 15-20 min to complete without any external assistance.

2.4 Scoring of TB knowledge Attitude and Practices Questionnaire

TB questionnaire contains a total of 16 questions comprised of three domains, including 7 questions for knowledge of TB, 6 questions about the attitude towards TB, and 3 questions regarding practices of TB. Each domain has multiple choices and participants could choose the most suitable answer for given questions based on their knowledge and experience. The frequency of correct and incorrect answers was recorded for the knowledge domain while in the case of attitude and practices positive behavior was considered as the correct answer and negative approach was taken as an incorrect answer.

2.5 Data Collection

The patient’s demographics characteristics and educational level details were collected by direct contact with the patient and from their medical records. After the data has been processed and modified, all responses were entered and analyzed in SPSS. Before data entry, manual data cleaning checks were used to identify unreadable marks on questionnaire, blank questions, and wrong coding. After completing the manual check process, frequencies were presented for each response and evaluated for the presence of missing responses. Descriptive statistics using frequency distribution tables were calculated to summarize socio-demographic characteristics, and the level of knowledge, attitude, and practices concerning TB. To compare scores of each domain with various demographic factors, the inferential statistics, i.e., Kruskal Wallis H test was applied.

3. RESULTS

3.1 Demographic Characteristics of the Participants

Total 337 TB patients responded to the questionnaire. Of these, 231(68.5%) were male and 106(31.5%) were females with a mean age of 46.5±17.1 years. The majority of participants (56.7%) were living in rural areas. Most of them reported being currently married 233(69.1%). For the level of education, 268(79.5%) have ≤ 12 years of education. The proportion of employment was high 245(72.7%) but the majority of participants 208(61.7%) had low income (>2000 RM).

3.2 Knowledge of TB

Knowledge about the cause, symptoms, mode of transmission, prevention, and treatment of TB are discussed in detail in Table 2. Around 229(68.0%) TB patients answered “bacteria/germs” as a cause of TB. For TB knowledge about the signs and symptoms of TB cough, > 3 weeks 244(72.4%) was the most commonly mentioned symptom of TB followed by weight loss 64.30%, shortness of breath 35.6%, and chest pain 30.50%. The majority of patients 281(83.4%) knew that TB is a curable disease. When inquired about pulmonary TB treatment
duration, 266(78.9%) choose 6 months in response. The most frequently mentioned possible source of transmission was air droplet 236(70%). Some people also mentioned sharing feeding utensils, handshaking, sharing regular use things, and others as a mode of TB transmission. In the case of preventive measures for TB, 178(52.8%) choose covering mouth and nose.

Table 1. Demographical characteristics of the study sample

| Characteristics                  | Patients n=337(%) |
|----------------------------------|------------------|
| Gender                           |                  |
| Male                             | 231(68.5)        |
| Female                           | 106(31.5)        |
| Mean age± S.D (years)            | 46.5±17.1        |
| Age range                        |                  |
| 18-35                            | 92(27.4)         |
| 35-50                            | 103(30.5)        |
| 50-65                            | 90(26.7)         |
| >65                              | 52(15.4)         |
| Race                             |                  |
| Malay                            | 137(40.6)        |
| Chinese                          | 152(45.2)        |
| Indians                          | 37(11)           |
| Others                           | 11(3.2)          |
| Education                        |                  |
| No formal education              | 25(7.4)          |
| ≤ 12 years                       | 268(79.5)        |
| >12 years                        | 44(13.1)         |
| Smoking                          |                  |
| Yes                              | 188(55.7)        |
| No                               | 149(44.3)        |
| Residence                        |                  |
| Rural                            | 191(56.7)        |
| Urban                            | 146(43.3)        |
| Income Level                     |                  |
| < 2000                           | 208(61.7)        |
| 3000-5000                        | 129(38.3)        |
| Marital Status                   |                  |
| Single                           | 72(21.4)         |
| Married                          | 233(69.1)        |
| Divorce                          | 32(9.5)          |
| Employment Status                |                  |
| No                               | 92(27.3)         |
| Yes                              | 245(72.7)        |
| Hospital visitors                |                  |
| General people                   | 312(92.6)        |
| Prisoners                        | 25(7.4)          |
Table 2. Assessment of patient’s Knowledge towards Tuberculosis

| Variables                              | Patients n=337(%) |
|----------------------------------------|-------------------|
| **A. Knowledge of TB**                 |                   |
| **Cause of TB**                        |                   |
| Bacteria/ germs                        | 229(68.0)         |
| Smoking                                | 59(17.5)          |
| Dust                                   | 7(2.1)            |
| Malnutrition                           | 2(0.6)            |
| Cold air                               | 9(2.7)            |
| Don’t know                             | 31(9.2)           |
| **Source of information to know about TB** |                   |
| Newspaper and electronic Media (TV, Radio) | 153(45.4)        |
| Family                                 | 47(13.9)          |
| Friends and colleagues                 | 179(53.1)         |
| Health workers                         | 184(54.5)         |
| **Most common Sign /Symptom of TB**    |                   |
| Chest pain                             | 103(30.5)         |
| Cough > 3 weeks                        | 244(72.4)         |
| Shortness of breath                    | 120(35.6)         |
| Weight loss                            | 217(64.3)         |
| Fatigue and fever                      | 91(27.0)          |
| Don’t know                             | 29(8.6)           |
| **TB is a curable disease**            |                   |
| No                                     | 31(9.2)           |
| Yes                                    | 281(83.4)         |
| Don’t know                             | 25(7.4)           |
| **Duration of Pulmonary TB**           |                   |
| 3 months                               | 11(3.3)           |
| 6 months                               | 266(78.9)         |
| 9 months                               | 11(3.3)           |
| More than 9 months                     | 20(5.9)           |
| Don’t know                             | 29(8.6)           |
| **Source of TB transmission**          |                   |
| Air droplet (sneezing and coughing)    | 236(70.0)         |
| Shake handing                          | 13(3.9)           |
| Sharing foodstuff and dishes           | 16(4.7)           |
| Sharing regular use things             | 7(2.1)            |
| Unhygienic work                        | 8(2.4)            |
| Don’t know                             | 57(16.9)          |
| **Prevent from TB disease**            |                   |
| Good nutrition                         | 26(7.7)           |
| Avoid sharing foodstuff and pots       | 79(23.4)          |
| Covering mouth and nose                | 178(52.8)         |
| Using separate room                    | 18(5.3)           |
| Don’t know                             | 36(10.7)          |
### Table 3. Assessment of patient’s attitude towards Tuberculosis

| Attitude towards TB                     |       |
|-----------------------------------------|-------|
| TB is a serious disease                 |       |
| Strongly agree                          | 142(42.1) |
| Agree                                   | 161(47.8) |
| Disagree                                | 8(2.4) |
| Don’t know                              | 26(7.7) |
| **Prefer for TB cure**                  |       |
| Private TB clinic                       | 27(8.0) |
| Public hospital                         | 304(90.2) |
| Pharmacy                                | 0(0) |
| Traditional healer                      | 3(0.9) |
| Self-treatment                          | 3(0.9) |
| **Symptoms of having TB**               |       |
| By persistent coughing                  | 181(53.7) |
| Sputum with blood                       | 41(12.2) |
| Loss of appetite                        | 12(3.6) |
| Fever and fatigue                       | 28(8.3) |
| Come to hospital for another disease    | 75(22.3) |
| **Reaction to know about TB diagnosis**|       |
| Fear                                    | 77(22.8) |
| Shocked                                 | 119(35.3) |
| Embarrassed                             | 15(4.5) |
| Depressed                               | 58(17.2) |
| Angry                                   | 25(7.4) |
| No any feelings                         | 43(12.8) |
| **TB treatment start**                  |       |
| Right after diagnosis                   | 285(84.6) |
| Delayed                                 | 52(15.4) |
| **Reasons for delayed treatment**       |       |
| Cannot leave work                       | 14(4.2) |
| Health facilities too far               | 8(2.4) |
| Transportation problem                  | 10(3.0) |
| Cost                                    | 5(1.5) |
| Don’t know where to go                  | 5(1.5) |
| Frightened to know if something worse   | 6(1.8) |
| Any other reason                        | 4(1.2) |
| Not applicable on participants          | 285(84.6) |

### Table 4. Assessment of practices of patients towards Tuberculosis

| Practices towards TB                     |       |
|-----------------------------------------|-------|
| **Feeling for other TB patients**       |       |
| Desire to help                          | 163(48.4) |
| Tend to stay away                       | 100(29.7) |
| Depression                              | 11(3.3) |
| No any feelings                         | 63(18.7) |
| **Family members behave with TB patient**|     |
| Avoid you                               | 37(11.0) |
Practices towards TB

Separate your utensils 46(13.6)
Caring for you 228(67.7)
Do nothing 26(7.7)

Fear after getting TB
Family negligence 81(24.0)
Social isolation 147(43.6)
Reduction of income 36(10.7)
Increased financial burden 73(21.7)

3.3 Attitude towards TB

Attitude towards TB disease in the current study area is summarized in Table 3. Among the study population, 142(42.1%) declared TB as an extremely serious disease while more than half of the study participants 161(47.8%) took it as a serious disease. Regarding the selection institution for treatment, 304(90%) preferred public sector hospitals. 285(84.6%) started TB treatment early and 52(15.4%) were delayed treatment, where the most prevalent reason for delayed treatment was "cannot leave work". About their reaction, if they had TB 119(35.5%), the patient's response was "shocked".

3.4 Practices towards TB

About 163(48.4%) of the participants desire to help other TB patients, while 100(29.7%) tend to stay away. They were also asked how a person who has TB is usually regarded/treated in their family and 228(67.7%) of them reported caring response by the family. On inquiring about their fear after getting TB, 147(43.6%) complained about "social isolation" and only 36(10.7%) were afraid of income reduction (Table 4).

3.5 Internal Consistency of Malay Version of TB knowledge, Attitude, and Practices Tool

Cronbach's alpha test of internal consistency was used for the measurement of reliability for the knowledge assessment data tool. The total standardized Cronbach's alpha as a measure of reliability was 0.72, which showed good internal consistency of the scale. Each item in the scale shared significantly to the overall reliability coefficient; deleting any of the items decreased the alpha level. The corrected item-with correlation ranged from 0.078 to 0.588 (Table 5). The TB knowledge, attitude, and practices tool were declared as a reliable instrument to assess the level of knowledge among the TB patients, as Cronbach's alpha value was within acceptable ranges. The test-retest reliability of the Malay version of TB knowledge, attitude, and practices tool were good with an ICC of 0.723, (95% CI: 0.678-0.765; P < 0.00).

| TB question No. | Mean ±SD | Corrected Item Total Correlation | Cronbach’s Alpha if Item Deleted |
|-----------------|----------|---------------------------------|---------------------------------|
| Question 1      | 2.28 ± 2.0 | 0.430                           | 0.697                           |
| Question 2      | 2.2 ± 1.4   | 0.279                           | 0.714                           |
| Question 3      | 2.47 ± 1.4  | 0.448                           | 0.695                           |
| Question 4      | 1.85 ± 0.5  | 0.588                           | 0.706                           |
| Question 5      | 2.17 ± 1.0  | 0.397                           | 0.705                           |
| Question 6      | 1.98 ± 1.8  | 0.369                           | 0.705                           |
| Question 7      | 2.66 ± 1.3  | 0.394                           | 0.702                           |
| Question 8      | 1.66 ± 0.8  | 0.465                           | 0.703                           |
| Question 9      | 1.85 ± 0.5  | 0.385                           | 0.713                           |
| Question 10     | 2.18 ± 1.6  | 0.263                           | 0.718                           |
| Question 11     | 2.60 ± 1.7  | 0.574                           | 0.676                           |
| Question 12     | 1.11 ± 0.3  | -0.109                          | 0.730                           |
| Question 13     | 7.35 ± 1.8  | -0.078                          | 0.766                           |
| Question 14     | 1.84 ± 1.1  | 0.503                           | 0.694                           |
| Question 15     | 2.47 ± 0.9  | 0.403                           | 0.705                           |
| Question 16     | 2.18 ± 1.0  | 0.240                           | 0.717                           |
4. DISCUSSION

This study was conducted to assess TB knowledge among TB patients and identifies weak prospects of TB awareness and key areas that need to be strengthened by continuous re-training of all TB patients. The main findings of this study are based on calculating the correct response of participants a) patient's knowledge regarding TB was comparatively higher than the attitude and practices b) overall attitudes regarding TB disease was positive c) practice competencies were good towards TB.

The current study differs from previously conducted KAP studies [14,16] in certain aspects. First, the present study was conducted among TB patients in tertiary care hospitals of the Malaysian state for evaluating their knowledge about TB. Secondly, a scoring system was developed and scores of participants for each domain were analyzed and correlated with various demographic factors.

Demographic characteristics have shown (Table 1) that most of our respondents were Chinese and the majority lie in the age group of 35-50 years. Besides that, 79.5% have ≤ 12 years educational background which is consistent with findings (63.5%) conducted in Malaysia [17]. Unlike our results, another study reported different education statuses in another state of Malaysia [18]. The majority of participants were not well educated. Perhaps the reason behind the good percentage of overall TB knowledge is patient counseling, provided by the two trained staff nurses to all newly diagnosed TB patients under the supervision of a physician, corroborated by other studies [19,20].

Around 70.0% of total patients knew the correct cause and source of TB infection, figure 1. While 17.5% considered smoking as a reason for TB. In line with our findings, 60.0% reported bacteria as the cause of TB [21] and conflicted with our findings another study reported 9.9% of participants knew Bacteria as a cause of TB [22].

Based on the current study findings, the participants had basic awareness about TB knowledge scale particularly (cause of disease, sign symptoms of disease, the transmission of disease, and prevention of disease, treatment duration). In the current study, 72.40% of patients knew cough for more than 3 weeks is one of the symptoms of TB infection. Fact that cough is mentioned as a common symptom of TB is significant as it would make a positive impact on the health-seeking behavior of the person. The finding is corresponding to the study in Ethiopia [15] and contradicted the study conducted in China [23].

![Fig. 1 Various responses of causes of TB](image-url)
Table 6. Mean score of knowledge, attitude, and practices of TB concerning to demographics characteristics (n=337)

| Characteristics | Knowledge score (Mean rank) | P-value | Attitude score (Mean rank) | P-value | Practices score (Mean rank) | P-value |
|-----------------|-----------------------------|---------|-----------------------------|---------|-----------------------------|---------|
| **Gender**      |                             |         |                             |         |                             |         |
| Male            | 158.6                       | <0.001  | 168.1                       | 0.80    | 158.8                       | 0.01    |
| Female          | 191.5                       |         | 170.7                       |         | 186.0                       |         |
| **Age (years)** |                             |         |                             |         |                             |         |
| 18-35           | 187.7                       | 0.04    | 169.9                       | 0.56    | 173.6                       | 0.48    |
| 35-50           | 155.0                       |         | 159.4                       |         | 167.4                       |         |
| 50-65           | 176.4                       |         | 177.7                       |         | 171.4                       |         |
| >65             | 150.6                       |         | 171.2                       |         | 150.4                       |         |
| **Ethnicity**   |                             |         |                             |         |                             |         |
| Malay           | 174.3                       | 0.22    | 176.7                       | 0.18    | 169.7                       | 0.80    |
| Chinese         | 166.7                       |         | 158.0                       |         | 168.3                       |         |
| Indian          | 175.1                       |         | 175.8                       |         | 163.6                       |         |
| Others          | 113.4                       |         | 200.6                       |         | 142.0                       |         |
| **Residence**   |                             |         |                             |         |                             |         |
| Rural           | 171.3                       | 0.60    | 172.1                       | 0.46    | 162.0                       | 0.21    |
| 165.9           |                             |         | 164.8                       |         | 174.5                       |         |
| **Income level**|                             |         |                             |         |                             |         |
| Low             | 168.4                       | 0.91    | 173.3                       | 0.26    | 171.5                       | 0.30    |
| High            | 169.8                       |         | 162.0                       |         | 160.8                       |         |
| **Education**   |                             |         |                             |         |                             |         |
| No formal       | 101.7                       | <0.001  | 154.6                       | 0.71    | 174.8                       | 0.75    |
| education       |                             |         |                             |         |                             |         |
| <12 years       | 170.2                       |         | 170.3                       |         | 165.6                       |         |
| ≥12 years       | 200.43                      |         | 168.7                       |         | 174.8                       |         |

In this study, 90.0% of the patients preferred public hospitals for treatment. The selection of the public sector for treatment might be because of free TB treatment facilities, responsible surveillance team pursuing non-compliance to medication, and serious monitoring of the patient for successful treatment rate and strict implementation of directly observed treatment (DOT) strategy. These findings are also supported by the earlier studies in Ethiopia where 71% [15] and 48% [24] patients preferred government health units for treatment some whereas. Around 83.4% of patients knew TB is a curable disease and 70.0% were aware of the
absence mode of TB transmission. Another study conducted in Ethiopia reported 79.9% knew the correct mode of acquiring TB [25]. Similarly, the patients attributed casual interaction such as eating together or sharing foodstuff and utensils with the infected individual as the source of transmission. About 52.8% knew how to prevent TB disease.

Previous research has documented that stigmatization towards TB is often reported by fear of social isolation [26]. Similar to current results (Table 3) social isolation was the leading threat of patients [27]. Hence, health workers need to address these misconceptions and disseminate accurate information to patients, as ignorance may promote stigmatization and social isolation of those diagnosed with TB. Lack of knowledge about transmission routes of TB may also provoke TB stigma.

The mean score of TB knowledge was significantly higher (P-value <0.001) in the current study (Table 6). The knowledge proportion regarding TB among female TB patients was significantly good as compare to male gender. In line with our results, studies reported TB knowledge levels (68%) [14] and 54% [15]. The attitude towards TB disease was also portrayed positively because of good knowledge of TB disease which resembles other studies showing a positive attitude, 57.1% [15]. TB was perceived as a serious disease by 89.9% of the patients (Table 3) similar to earlier research 55.4% [15] and 84% [12]. A significantly higher difference was observed between mean knowledge score for highly educated patients compared with participants less than college level education, the more educated patients have maximum scores in knowledge.

The findings of this study strongly indicate that further programs for the community focused on increasing public awareness and critical interventions are compulsory to improve the knowledge, attitudes, and practices towards TB disease. Meanwhile, to ensure the success of the national TB program, the authorities such as the federal ministry of health, regional health offices, and non-governmental organizations (NGOs) should give priority attention towards disseminating TB guidelines. On the other hand, utilization of the media can play an essential role in teaching the people, as well as health education programs to increase communities’ understanding about tuberculosis are required. Current study findings can be used as scientific evidence to help design and provide effective health education in clinical settings.

The analyses also discover several predictors of correct knowledge, attitude and practices of TB. Consistent with prior findings, we discover that age was significantly associated with having correct knowledge. The results demonstrated that, compared to persons aged 30-50 years, persons older than 50 years were more likely to report correct knowledge. These findings are inconsistent to earlier studies, conducted in Ghana [28] and India [29].

Even though this study produced findings that are useful for directing interventions to raise general knowledge of disease cause, symptoms, transmission, preventions and minimize stigma understanding about TB and minimize the poor attitude and practices towards TB. A limitation inherent in most KAP studies is the cross-sectional study design and convenience sampling technique used to recruit the participants that could have created some bias. Although The present study was conducted in limited resources. Future studies need to include a more extensive sample of TB patients from different health centers and tertiary hospitals in Penang to explore more accurate and in-depth results. In addition, lack of focus group discussions, which could have been used to interpolate the findings, lacked information about MDR TB.

5. CONCLUSION

In current study, a large proportion of participants had limited knowledge regarding cause and prevention of TB. While Female gender, age group > 50 years and participants with higher educational level have significant difference in mean score of knowledge as compare to other groups was observed. Comparatively, male participants were less likely to be aware of TB disease. In general, the TB patients had basic knowledge, despite that, a substantial number of patients have perceived that good nutrition and avoided sharing foodstuff and use the separate room as a preventing measure of TB. Therefore, health education strategy and awareness programs among TB patients might bring significant change in their knowledge especially about transmission, preventive measures to improve the family and community behavior with TB patients.
AVAILABILITY OF DATA AND MATERIALS
The datasets used and analyzed during the current study are available from the corresponding author on reasonable request.

CONSENT
written consent for participating in this study was taken from each patient.

ETHICAL APPROVAL
The study was approved by the Medical Research Ethics Committee (MREC), Ministry of Health, and Malaysia (Registration ID: NMRR-18-1145-40397; MREC reference: dim. KKM/NIHSEC P18-1198(6).

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COMPETING INTERESTS
Authors have declared that no competing interests exist.

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