Knowledge and perception of treatment among tuberculosis patients attending primary care clinics in Malaysia

Nesamalar Balakrishnan¹, Ezura Madiana Md Monoto², Noorlaili Mohd Tohit², Asrul Abdul Wahab³

¹ Pasir Gudang Health Clinic, Ministry of Health Malaysia, Pasir Gudang, Johor, Malaysia
² Department of Family Medicine, Faculty of Medicine, Universiti Kebangsaan Malaysia Medical Centre, Cheras, Kuala Lumpur, Malaysia
³ Department of Medical Microbiology and Immunology, Faculty of Medicine, Universiti Kebangsaan Malaysia Medical Centre, Cheras, Kuala Lumpur, Malaysia

Abstract
Introduction: Tuberculosis is a disease of public health concern. It can be treated effectively with good knowledge about the disease and complete adherence to the recommended treatment regime. This study is intended to assess the level of knowledge and perception of treatment among tuberculosis patients attending primary care clinics.

Methodology: We conducted a cross-sectional study using a validated self-administered questionnaire among tuberculosis patients attending primary care clinics in Johor Bahru district. A total of 208 tuberculosis patients were enrolled in this study through convenience sampling. We assessed the general knowledge, transmission, causes, and prevention of tuberculosis, where higher scores indicated better knowledge. For the perception of treatment, a higher mean score indicated a more negative perception.

Results: The mean score for knowledge on tuberculosis was 54.33 ± 12.78, ranging from 25 to 88.9%. The mean score for perception was 2.75±0.52, ranging from 2.15-3.39. We found that although 88.9% of respondents knew a person could be infected with TB through inhalation of tuberculosis bacilli, a majority believed that smoking (68.2%), sharing food (69.2%), and eating from the same plate (66.8%) are causes of tuberculosis. Moreover, there was still a negative perception regarding the treatment of tuberculosis with the highest mean score for the statement ‘I am afraid if I am told I am tuberculosis positive’.

Conclusions: We found that there were gaps in knowledge among tuberculosis patients. Intermittent counseling during the treatment re-enforces the knowledge of tuberculosis. An updated standardized counseling sheet of tuberculosis Health Education should be included along with staff training to update their knowledge as part of their important role in health education in tuberculosis prevention.

Key words: knowledge; perception; tuberculosis.

J Infect Dev Ctries 2021; 15(8):1205-1211. doi:10.3855/jidc.12891

Introduction

Tuberculosis (TB) caused by the Mycobacterium tuberculosis bacteria can affect many systems in the human body with a wide clinical presentation of signs and symptoms. In 2016, the World Health Organization (WHO) reported that 10.4 million people were diagnosed with tuberculosis with an estimated 600,000 cases of multi-drug resistant TB [1]. Ending the TB epidemic by 2030 is one of the targets of the newly adopted Sustainable Developmental Goals by the WHO [1]. TB control is being achieved in countries with high-income economies, however, TB continues to plague people living in countries with low-income and lower-middle-income economies [2]. In 2019, the incidence of TB in Malaysia was 92 cases per 100,000 population [3].

The National TB Control Program in Malaysia was established in 1961, and has been striving to improve TB control and outcomes. This program encompasses prevention strategies, early detection, treatment, and management of TB. Starting in 1973, each state in Malaysia had a dedicated TB team to conduct the above tasks. Progressing forward, in 1994, with the implementation of an integrated primary care concept in Malaysia, this program is placed under the general medical and health system. Every year, the state level must report to the Disease Control Division in the Ministry of Health regarding their progress [4]. This shows that treating TB is one of the priorities in the Malaysian health care system.

Studies regarding knowledge, attitude, and perception have been carried out throughout different
parts of the world. Many of them show that lack of adequate knowledge affects the patient’s compliance. In northwest Rajasthan, 100 percent of the respondents in the community did not know the name of the vaccine for TB [5]. In another community study in India, the majority did not know TB symptoms [6]. Misconceptions and wrong beliefs held by patients contribute to poor compliance [7]. In Malaysia, it has been shown that poor knowledge about tuberculosis among TB patients is associated with poorer compliance [8]. TB patients are being treated in primary care clinics throughout Malaysia. However, knowledge regarding TB and perception on treatment in the

primary care clinic setting is lacking. The health care providers in the primary care clinic are supposed to provide relevant health education during the initiation of TB medications. Generally, there is a checklist for educating TB patients before commencing their treatment. The objective of this education is to ensure the patients understand their disease, medications during the treatment, and the medication side effects. Thus, the researchers aimed to determine the level of knowledge and perception of treatment among TB patients attending selected primary care clinics in Malaysia.

Methodology

Study population and sample

The cross-sectional study was conducted among tuberculosis patients taking treatment from all 13 primary care clinics in Johor Bahru district. Johor Bahru is the capital state of Johor, which is a state located in the South of Peninsular Malaysia. There are almost 500,000 people who live in Johor Bahru. The method of sampling was convenience sampling. We included all TB patients aged 18 and above, on treatment or surveillance, and those who understood Malay or English language. Those who were acutely ill and did not consent were excluded from the study. Ethical approval for the study was obtained from the Secretariat of Research and Innovation Universiti Kebangsaan Malaysia (FF-2017-199) and the Medical Research and Ethics Committee (NMRR-17-663-34746). This study was done from June 2018 to November 2018.

Questionnaire and variables

We used a self-administrated validated questionnaire available in both Malay and English language. This questionnaire on Knowledge of Tuberculosis and the Perception of Tuberculosis Treatment Among Tuberculosis Patients in Malaysia was developed and validated with Cronbach’s alpha of 0.751 [9].

The questionnaire has three sections. The first section is about the respondent’s sociodemographic information. The second section tested on the knowledge of patients about TB which consists of general knowledge, causes, prevention, and mode of transmission of TB whereby the respondents were required to answer ‘Yes’, ‘No’, or ‘Unsure’ for each of the 36 questions. The correct answer was given one mark while incorrect and ‘Unsure’ answers were scored zero. The score was then converted to a percentage. The higher the score indicated better knowledge. The third

| Variables                     | Frequency (%) |
|-------------------------------|---------------|
| Age (Mean ± SD (years))       | 40.7 ± 15.75  |
| Gender                        |               |
| Male                          | 125 (60.1)    |
| Female                        | 83 (39.9)     |
| Race                          |               |
| Malay                         | 139 (66.8)    |
| Chinese                       | 40 (19.2)     |
| Indian                        | 18 (8.7)      |
| Others                        | 11 (5.3)      |
| Marital Status                |               |
| Single                        | 76 (36.5)     |
| Married                       | 115 (55.3)    |
| Divorced / Widowed            | 17 (8.2)      |
| Education level               |               |
| Not school                    | 10 (4.8)      |
| Primary                       | 46 (22.1)     |
| Secondary                     | 119 (57.2)    |
| Tertiary                      | 33 (15.9)     |
| Employment Status             |               |
| Government                    | 14 (6.7)      |
| Private                       | 80 (38.5)     |
| Self                          | 34 (16.3)     |
| Non-employed                  | 80 (38.5)     |
| Risk factors                  |               |
| Smoker                        | 72 (34.6)     |
| Diabetes mellitus             | 53 (25.5)     |
| Cancer                        | 3 (1.5)       |
| Human immunodeficiency virus (HIV) infection | 0 |
| Types of Tuberculosis         |               |
| Pulmonary                     | 181 (87)      |
| Extra-Pulmonary               | 17 (8.1)      |
| Both                          | 10 (4.8)      |
| Compliance to TB treatment    | 207 (99.5)    |
| Symptoms experienced by TB patients |         |
| Reduced appetite              | 109 (52.4)    |
| Cough with phlegm             | 104 (50.0)    |
| Reduced body weight           | 90 (43.3)     |
| Fever                         | 73 (35.1)     |
| Cough > 2 weeks               | 30 (14.4)     |
| Night sweats                  | 27 (13.0)     |
| Haemoptysis                   | 18 (8.6)      |
section assessing the perception of TB treatment consists of 10 questions. The perception was scored according to five Likert scale options of ‘Strongly disagree’, ‘Disagree’, ‘Unsure’, ‘Agree’ and ‘Strongly agree’. Scores of 1 to 5 were given respectively with a higher mean score reflecting a more negative perception.

The clinical characteristics of the patients were obtained from their TB folders, particularly from the TBIS 10A-1 form. TBIS 10A-1 form is the standard form used by the Ministry of Health Malaysia to record the details of a TB patient before commencing TB treatment. The data gathered from this form included the underlying medical conditions and symptoms experienced by the patient before commencing TB treatment.

**Statistical analysis**

Data were analyzed using SPSS version 23. Categorical data were described as frequency and percentage, while continuous data were described as mean and standard deviation. Responses to all questions on knowledge and perception were recorded in numbers and percentages. Pearson Correlation analysis, Independent T-test and One-way ANOVA were the statistical analysis used in the study. The two-tailed p-value < 0.05 were taken as statistically significant for all analysis.

| Table 2. Patients’ knowledge about tuberculosis. |
|-----------------------------------------------|
| **Question**                                  |
| **Yes (%)**                                   |
| **No (%)**                                    |
| **Unsure (%)**                                |
| **General knowledge about TB**                |
| a. Shaking hands with someone with TB         | 23 (11.1) | 137 (65.9) | 48 (23.1) |
| b. Inherited                                  | 53 (25.5) | 100 (48.1) | 55 (26.4) |
| c. Smoking                                    | 108 (51.9) | 66 (31.7) | 34 (16.3) |
| d. By inhaling TB germs in the air            | 185 (88.9) | 3 (1.4) | 20 (9.6) |
| e. Sharing foods                              | 113 (54.3) | 64 (30.8) | 31 (14.9) |
| f. Eating from the same plate                 | 104 (50.0) | 69 (33.2) | 35 (16.8) |
| g. Through touching items in public places (doorknobs, handles in transportation) | 35 (16.8) | 100 (48.1) | 73 (35.1) |
| **Knowledge about TB prevention**             |
| a. Avoid shaking hands with TB patients       | 50 (24.0) | 114 (54.8) | 44 (21.2) |
| b. Covering mouth and nose when TB patients is coughing | 191 (91.8) | 8 (3.8) | 9 (4.3) |
| c. Covering mouth and nose when TB patients is sneezing | 197 (94.7) | 5 (2.4) | 6 (2.9) |
| d. Avoid sharing foods with TB patients       | 141 (67.8) | 43 (20.7) | 24 (11.5) |
| e. Wash hand after touching items in public places | 154 (74.0) | 23 (11.1) | 31 (14.9) |
| f. Closing window at home                    | 31 (14.9) | 136 (65.4) | 41 (19.7) |
| g. Taking healthy food                        | 156 (75.0) | 22 (10.6) | 30 (14.4) |
| h. By taking BCG vaccination                  | 100 (48.1) | 19 (9.1) | 89 (42.8) |
| i. By praying                                 | 130 (62.5) | 46 (22.1) | 32 (15.4) |
| **Knowledge about TB infection**              |
| a. From anyone                                | 195 (93.8) | 5 (2.4) | 8 (3.8) |
| b. Poor people                               | 107 (51.4) | 56 (26.9) | 45 (21.6) |
| c. Homeless people                           | 112 (53.8) | 50 (24.0) | 46 (22.1) |
| d. Alcoholics                                 | 120 (57.7) | 38 (18.3) | 50 (24.0) |
| e. Drug users                                 | 140 (67.3) | 26 (12.5) | 42 (20.2) |
| f. People living with HIV/AIDS                | 128 (61.5) | 16 (7.7) | 64 (30.8) |
| g. People who have been in prison             | 99 (47.6) | 32 (15.4) | 77 (37.0) |
| **Knowledge about TB transmission**          |
| a. Through contact with TB patients           | 151 (72.6) | 19 (9.1) | 38 (18.3) |
| b. Shaking hands with TB patients             | 54 (26.0) | 111 (53.4) | 43 (20.7) |
| c. By sexual intercourse with TB patients     | 61 (29.3) | 51 (24.5) | 96 (46.2) |
| d. From TB mother                             | 116 (55.8) | 26 (12.5) | 66 (31.7) |
| e. Sharing cigarette with TB patients        | 145 (69.7) | 18 (8.7) | 45 (21.6) |
| f. Weather changing                           | 27 (13.0) | 94 (45.2) | 87 (41.8) |
| g. Through TB germs in the air                | 185 (88.9) | 3 (1.4) | 20 (9.6) |
| **Knowledge about TB treatment**              |
| a. TB can be cured                            | 180 (86.5) | 0 | 28 (13.5) |
| b. Herbs mixed                               | 33 (15.9) | 112 (53.8) | 63 (30.3) |
| c. Rest without medicine                     | 14 (6.7) | 173 (83.2) | 21 (10.1) |
| d. Taking medicine prescribed by health clinic | 199 (95.7) | 3 (1.4) | 6 (2.9) |
| e. Shaman                                    | 1 (0.5) | 172 (82.7) | 35 (16.8) |
Results

Test of normality was done using Shapiro-Wilk. The sample was normally distributed with a p-value of more than 0.05. Table 1 showed the sociodemographic and clinical characteristics of our respondents. We recruited 208 TB patients in this study with the majority being males (60.1%). The mean age of patients was 40.7±15.75 years ranging from 18 to 83 years old. Most of the patients were of Malay race (66.8%) and about half were married (55.3%). Almost all had formal education (95.2%) and more than half were working (61.5%). About one-quarter of the respondents were known diabetics and one-third of them were active smokers. The majority had pulmonary TB (81%). There was good compliance among the respondents (99.5%). The top three symptoms experienced by the patients were reduced appetite (52.4%), cough with phlegm (50.0%), and reduced body weight (43.3%).

The mean for TB knowledge score in percentage was 54.33±12.78, with the lowest score of 25.0% and the highest score of 88.9%. Table 2 shows the responses of TB knowledge. General knowledge of TB is somewhat poor, with many believed that smoking (68.2%), sharing food (69.2%), and eating from the same plate (66.8%) as reasons why someone gets infected with TB. A good thing to note is that majority of the respondents (88.9%) knew that people could get TB by inhaling TB germs in the air. For the domain on prevention, many still believed that avoiding sharing food (79.3%), washing hands after touching items in public places (88.9%), taking healthy food (89.4%), and praying (77.9%) can prevent TB infection. Surprisingly, more than half (51.9%) of the respondents did not know the role of BCG vaccination. We also noted that our respondents had good knowledge of who can get TB (93.8%). However, they did not know much about the higher risk group population who can be infected with TB and many believed TB is a sexually transmitted disease (75.5%) and could also be transmitted from sharing cigarettes (91.3%). There was good knowledge on the cure of TB (86.5%) and taking treatment from the clinic to cure TB (95.7%). However, many still believed in herbal mixtures to treat TB (46.2%).

The mean for the perception of TB treatment was 2.75 ± 0.52, ranging from 2.15-3.39. There were 10 statements assessing the patient’s perception of TB treatment as shown in Table 3. The top 3 most negative perceptions are ‘I am afraid that I will be told that I am TB positive’ (3.39±1.24), ‘I am afraid that I will lose my job/income’ (3.03 ± 1.21), and ‘I am afraid that TB treatment will be unpleasant and difficult’ (2.97 ± 1.20). We looked into the association between knowledge and sociodemographic as well as knowledge and clinical variables of 208 respondents with the mean knowledge

Table 3. Perception of treatment among tuberculosis patients.

| No. | Perceptions towards treatment | Strongly Disagree n (%) | Disagree n (%) | Unsure n (%) | Agree n (%) | Strongly Agree n (%) | Mean ± SD |
|-----|-------------------------------|-------------------------|---------------|-------------|-------------|---------------------|----------|
| 1.  | I am afraid that I will be told I am TB Positive | 19 (9.1) | 40 (19.2) | 27 (13.0) | 84 (40.4) | 38 (18.3) | 3.39 ± 1.24 |
| 2.  | I am afraid that people will talk about my visit to the clinic | 18 (8.7) | 81 (38.9) | 26 (12.5) | 67 (32.2) | 16 (7.7) | 2.91 ± 1.17 |
| 3.  | I don't want to cough into the specimen bottle | 40 (19.2) | 24 (11.5) | 20 (9.6) | 20 (9.6) | 4 (1.9) | 2.15 ± 0.91 |
| 4.  | I don't want to cough into the specimen bottle | 19 (9.1) | 77 (37.0) | 24 (11.5) | 74 (35.6) | 14 (6.7) | 2.93 ± 1.17 |
| 5.  | I am afraid that TB treatment will interfere my social lives | 19 (9.1) | 83 (39.9) | 20 (9.6) | 66 (31.7) | 20 (9.6) | 2.92 ± 1.21 |
| 6.  | There are long queues at the clinics | 19 (9.1) | 71 (34.1) | 23 (11.1) | 74 (35.6) | 21 (10.1) | 3.03 ± 1.21 |
| 7.  | I am afraid that I will lose my job/income | 18 (8.7) | 80 (38.5) | 19 (9.1) | 73 (35.1) | 18 (8.7) | 2.97 ± 1.20 |
| 8.  | I am afraid that TB treatment will be unpleasant and difficult | 35 (16.8) | 100 (48.1) | 45 (21.6) | 19 (9.1) | 9 (4.3) | 2.36 ± 1.01 |
| 9.  | I perceive that I can die from TB if I do not take your drugs regularly | 40 (19.2) | 103 (49.5) | 26 (12.5) | 23 (11.1) | 16 (7.7) | 2.38 ± 1.14 |
| 10. | I perceive that TB treatment can take at least one year | 27 (13.0) | 112 (53.8) | 34 (16.3) | 23 (11.1) | 12 (5.8) | 2.43 ± 1.04 |
Discussion

This study showed that the respondents did not score well for domains on transmission and prevention. This has been seen in previous studies where respondents believed that transmission of TB was through contaminated food [10,11]. Similarly, a high proportion of our respondents did not know the role of BCG vaccination as was seen in another study [5]. More focused counseling should be given to TB patients in the identified areas causing misconception.

Our study also found that the respondents were afraid of the stigma associated with TB. The majority was afraid of being told if they have TB, worry that TB will affect their income, and the treatment being unpleasant. In response to this, TB patients might need to adapt their activities of daily living to avoid the social consequences of the disease. This was seen in a community study done in Sabah, where all patients changed their daily activities (e.g. separation of utensils, new sleeping arrangements, reduced social activities), with one patient’s income being affected when his community knew he had TB [11]. Hence, it is important to reduce this negative attitude by conducting health promotion among patients and the public.

In this study, there was no significant association between the level of knowledge with education.

Table 4. Association between tuberculosis knowledge with sociodemographic and clinical characteristics.

| Variables           | Knowledge (Mean ± SD) | p-value | 95% Confidence Interval |
|---------------------|-----------------------|---------|-------------------------|
| Age                 | 40.69 ± 15.75         | 0.80*   | (-0.12 - 0.15)          |
| Gender              |                       |         |                         |
| Male                | 55.17 ± 12.73         | 0.24†   | (-1.45 - 0.71)          |
| Female              | 53.05 ± 12.90         |         |                         |
| Race                |                       |         |                         |
| Malay               | 55.26 ± 12.16         | 0.21†   | (1.39 - 1.63)           |
| Chinese             | 51.81 ± 13.34         |         |                         |
| Indian              | 50.93 ± 13.47         |         |                         |
| Others              | 56.11 ± 16.76         |         |                         |
| Marital status      |                       |         |                         |
| Single              | 54.39 ± 13.58         | 0.90‡   | (1.70 - 1.94)           |
| Married             | 54.08 ± 12.28         |         |                         |
| Divorced            | 53.97 ± 10.74         | 0.92‡   | (2.74 - 2.94)           |
| Widowed             | 55.75 ± 17.17         |         |                         |
| Education level     |                       |         |                         |
| No school           | 56.11 ± 16.76         |         |                         |
| Primary             | 53.44 ± 13.42         | 0.92‡   | (2.74 - 2.94)           |
| Secondary           | 54.62 ± 12.79         |         |                         |
| Tertiary            | 53.96 ± 10.67         |         |                         |
| Employment status   |                       |         |                         |
| Government          | 45.24 ± 11.86         | 0.48†   | (2.91 - 3.27)           |
| Private             | 55.14 ± 12.74         |         |                         |
| Self-employed       | 52.94 ± 11.44         | 0.48†   | (2.91 - 3.27)           |
| Non-employed        | 55.44 ± 13.05         |         |                         |
| Smoking status      |                       |         |                         |
| Smoker              | 54.40 ± 12.93         | 0.95†   | (-3.79 - 3.57)          |
| Non-smoker          | 54.29 ± 12.75         |         |                         |
| Diabetes Mellitus   |                       |         |                         |
| Yes                 | 53.98 ± 13.61         | 0.82†   | (-3.56 - 4.48)          |
| No                  | 54.44 ± 12.53         |         |                         |
| Tuberculosis Type   |                       |         |                         |
| Pulmonary           | 54.21 ± 13.19         | 0.70†   | (1.41 - 1.64)           |
| Extra-pulmonary     | 54.58 ± 9.96          |         |                         |
| Both                | 56.11 ± 9.87          |         |                         |

All data was normally distributed. In all analysis, p-value < 0.05 was considered significant. * Person’s correlation analysis; † Independent t-test; ‡ One-way ANOVA.
However, in a previous study, patients with a higher level of education scored significantly higher than the rest [8,12-14]. This can be because basic knowledge of TB has reached most TB patients in our population through health education; hence, the effect of the educational level was not seen.

There was no association seen between knowledge and clinical characteristics in this study. Despite the medical co-morbidities our respondents had, it did not affect their knowledge level on TB. Previous studies have shown that knowledge on TB symptoms improves health-seeking behavior [12]. In this study, despite some knowledge gaps, there was very good compliance. This can be due to our Directly Observed Treatment (DOTs) program and good defaulter tracing system in our primary care. The DOTs is the most effective treatment strategy for controlling TB [15]. The dedicated team in charge of the TB patients in our primary care clinics would trace and contact the defaulters to make sure they completed the treatment.

The prevalence of diabetes among patients with tuberculosis in this study was 25.5%, similar to another study done on TB patients in Malaysia in 2011, 29.9% [16]. This rate is however higher than another recent study in Bhopal that reported a prevalence of 12.39% [17]. In 2011, a ‘Collaborative Framework for care and control of Diabetes and TB’ was launched by the WHO and the International Union Against Tuberculosis and Lung Disease (The Union) with one of the important aspects being screening for diabetes in a TB patient and vice-versa. Having diabetes is associated with poorer outcomes for TB patients including delayed sputum conversion rates, a higher rate of relapse after treatment, and a higher risk of death [18]. There is a need for increased attention when managing diabetic patients with TB. Diabetes patients should be informed of their risk and the symptoms of tuberculosis.

Conclusions

Counseling should be given to all TB patients. Intermittent counseling throughout the course of treatment helps to reinforce knowledge of TB. It also gives patients a chance to ask and clarify any misconceptions. A standardized counseling sheet on TB Health Education should include the mode of transmission and prevention. This counseling sheet should be used in all patients before commencing treatment. Thus, a revision of the current checklist is indicated along with staff training so that their knowledge on TB can be updated. Doctors and health care staff should be encouraged to attend short training courses held on TB education aids and guidelines as they play an important role in health education in disease prevention.

Acknowledgements

The authors thank the Dean of Medical Faculty Universiti Kebangsaan Malaysia, District Health Office Johor Bahru, and all primary care clinics under its administration and the Ministry of Health Malaysia for the support and assistance given. Also, to Dr Omar Salad Elmi for allowing us to use his questionnaire in our study.

References

1. World Health Organization (WHO) (2018) Fact sheet on tuberculosis (Updated January 2018). Weekly Epidemiological Record 93: 39–43. Available: https://apps.who.int/iris/handle/10665/259936. Accessed: 19 August 2021.
2. Castro KG, LoBue PA (2011) Bridging implementation, knowledge, and ambition gaps to eliminate tuberculosis in the United States and globally. Emerg Infect Dis 17: 337-342.
3. World Health Organization (WHO) (2020) Tuberculosis profile: Malaysia. Available: https://worldhealthorg.shinyapps.io/tb_profiles/?_inputs_&entity_type=%22country%22&lan=%22EN%22&iso2=%22MY%22. Accessed: 19 August 2021.
4. Abd Rahman NH, Mokhtar KS (2015) Challenges of national tuberculosis control program implementation: the Malaysian experience. Procedia - Social and Behavioral Sciences. 172: 578-584.
5. Jangid VK, Agrawal NK, Yadav GS, Pandey S, Mathur BB (2016) Knowledge and awareness of the tuberculosis in tuberculosis patients at a tertiary care centre in North West Rajasthan, India. National J Community Med 7: 262-268.
6. Easwaran M, Ramachandran D, Ramasamy R, George N, Mathew M, Bazroy J, Singh Z (2015) Knowledge, attitude, and practice regarding tuberculosis among rural population in Tamil Nadu. Int J Med Sci Public Health 4: 1681-1684.
7. Jin J, Sklar GE, Min Sen Oh V, Shu Chuen L (2008) Factors affecting therapeutic compliance: a review from the patient’s perspective. Ther Clin Risk Manag 4: 269–286.
8. Liam CK, Lim KH, Wong CM, Tang BG (1999) Attitudes and knowledge of newly diagnosed tuberculosis patients regarding the disease, and factors affecting treatment compliance. Int J Tuberc Lung Dis 3: 300-309.
9. Elmi OS, Hasan H, Abdullah S, Jeab MZM, Nadiah WA, Zulfafil BA, Naing NN (2014) Development and validation of a questionnaire on the knowledge of tuberculosis and the perception of tuberculosis treatment among tuberculosis patients in Malaysia. Int J Med Sci Public Health 3: 352-357.
10. Mokhtar KS, Abd Rahman NH, Mohd Shariff N,Wan Mohd Nor WA (2012) Tuberculosis in Malaysia: a study on the level of societal awareness and stigma. IOSRJHSS 1: 59-64.
11. Rundi C (2010) Understanding tuberculosis: perspectives and experiences of the people of Sabah, East Malaysia. J Health Popul Nutr 28: 114-123.
12. Hoa NP, Thorsen AEK, Long NH, Diwan VK (2003) Knowledge of tuberculosis and associated health-seeking behavior among rural Vietnamese adults with a cough for at least three weeks. Scandinavian Journal of Public Health 31 Suppl 62: 59-65.
13. Koay TK (2004) Knowledge and attitudes towards tuberculosis among the people living in Kudat district, Sabah. Med J Malaysia 59: 502-511.

14. Portero Navio JL, Rubio Yuste M, Pasicatan MA (2002) Socio-economic determinants of knowledge and attitudes about tuberculosis among the general population of Metro Manila, Philippines. Int J Tuberc Lung Dis 6: 301-306.

15. Aziah AM (2004) Tuberculosis in Malaysia: Combating the old nemesis. Med J Malaysia 59: 1-3.

16. Syed Suleiman SA, Daud MIA, Ali JM, Abdul Razak M, Mohamed AAM (2012) Role of diabetes in the prognosis and therapeutic outcome of tuberculosis. Int J Endocrinol 2012: 645362.

17. Nagar V, Gour D, Pal DK, Singh AR, Joshi A, Dave L (2018) A study on prevalence of diabetes and associated risk factors among diagnosed tuberculosis patients registered under Revised National Tuberculosis Control Programme in Bhopal District. J Family Med Prim Care 7: 130–136.

18. Jiménez-Corona ME, Cruz-Hervert LP, Garcia-García L, Ferreyra-Reyes L, Delgado-Sánchez G, Bobadilla-Del-Vall M, Canzales-Quintero S, Ferreira-Guerrero E, Báez-Saldaña R, Téllez-Vázquez N, Montero-Campos R, Mongua-Rodríguez N, Martínez-Gamboa RA, Sifuentes-Osornio J, Ponce-de-León A (2013) Association of diabetes and tuberculosis: impact on treatment and post-treatment outcomes. Thorax. 68: 214-220.

Corresponding author
Ezura Madiana Md Monoto, MBBS, Doctor of Family Medicine
Department of Family Medicine, Faculty of Medicine, Universiti Kebangsaan Malaysia, 56000, Cheras, Kuala Lumpur, Malaysia
Phone: +603-91456117
Fax: +603-91459479
Email: ezura@ppukm.ukm.edu.my

Conflict of interests: No conflict of interests is declared.