TUBERCULOSIS (TB) HEALTH EDUCATION: TB KNOWLEDGE AMONG SMEAR-POSITIVE PULMONARY TUBERCULOSIS (PTB) PATIENTS IN KUALA LUMPUR AND ITS ASSOCIATION WITH SPUTUM SMEAR CONVERSION

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Abstract
The primary objective of this study was to determine the factors influencing TB literacy among smear-positive pulmonary TB patients at the second month of treatment. The secondary objective was to investigate the difference in TB knowledge between patients with persistent sputum smear-positive and smear converted patients.The study was conducted as a cross-sectional study which involved 150 smear positive PTB patients. Patients' knowledge of TB was assessed using a set of a pre-tested standardized questionnaire. Data were entered and analyzed using SPSS software version 24.0 for Windows (IBM Corporation, New York, United States). Descriptive data for continuous variables are presented as mean and standard deviation. Meanwhile, descriptive data for categorical variables are presented as frequencies and percentages. Data were analyzed by using binary logistic regression analysis. Overall, 26.0% (n= 39) of the patients had an unsatisfactory knowledge of Tuberculosis. Although the majority of the patients were aware that TB is infectious, many scored low for three critical aspects of stopping TB which were poor knowledge on the source of TB infection, the mode of transmission, and the correct preventive measures. Two factors which were gender (male: adj OR= 3.91, 95% CI= 1.09-14.00) and ethnicity (Chinese: adj OR= 10.24, 95% CI= 3.03-34.63; Immigrants: adj OR= 4.59, 95% CI= 1.10-19.12) were independently associated with unsatisfactory TB knowledge after controlling the age, gender, ethnicity, job and level of education. No significant difference was observed between the mean knowledge of patients with persistent sputum positivity (5.35±1.40) and those sputum converted TB patients (5.47±1.64) (crude OR= 0.95, 95% CI= 0.77-1.17, p=0.628). Gender and ethnicity were the independent factors that affected TB literacy. However, the TB literacy does not significantly associated with patients' smear positivity at second month of intensive anti-TB treatment.

***Keywords*:** Pulmonary Tuberculosis, Knowledge, Malaysia

Introduction

Tuberculosis (TB) is one of the oldest diseases in human history and has affected the human race through its history and prehistory (1). Nevertheless, TB remains one of the top ten worldwide causes of death from a single infectious agent (*Mycobacterium tuberculosis*) ranking above HIV/AIDS. With continuous global efforts in combating TB, TB incidence has declined by an estimate of 41% between 1990 and 2013 (2). However, the rate of TB remains high in Malaysia. The incidence of TB in Malaysia was reported at 78.62 cases per 100,000 populations with a mortality rate of 6.65 in 2018. Out of 25,837 new cases of TB reported, 1,900 patients were infected with HIV/AIDS (3).

Improving patient knowledge and awareness of TB is one of the vital approaches in enhancing patient-centred care and desired preventive behaviour towards the goal of the End TB strategy (4). Low TB literacy, especially on the source of infection and transmission of TB was observed in both the TB patients and those at high risk of contracting TB (5-9). Furthermore, low TB literacy among TB index patients was also shown to negatively

impact the cascade of latent TB screening among their contacts. It was evidenced by only 43% contact identification, and only 3% started latent TB treatment which further adding to the difficulty of preventing the spread of TB (10). Previous studies have shown the negative effect of poor knowledge of TB on the treatment non-compliance, increase risk of TB infection, increase treatment delays, and poor health-seeking behaviour of TB patients (11-13).

Previous research in Bangladesh found that socio-demographic factors influence the knowledge level of TB patients (14). Male TB patients aged 21-35 were found to have greater knowledge of TB than female TB patients of the similar aged. Furthermore, Mondal and other researchers stated that TB patients from urban areas with a high educational status have good knowledge of TB, which improves health-seeking behaviours and prevents treatment delays (14). These findings were supported by a study in Yemen by Anaam et al. (15), which discovered that level of education was strongly associated with knowledge of tuberculosis and its treatment, followed by age and place of residence.

Furthermore, according to Balakrishnan et al. (16), there was a lack of knowledge among TB patients receiving treatment in Johor Bahru, Malaysia. This is due to the fact that many TB patients still feel threatened by the TB stigma, as well as having misconceptions and negative attitudes toward TB treatment. According to Onyango, Goon, and Rala (17), it was because they believe it is difficult and time-consuming. This resulted in patients having a low regard for TB test results and treatment follow-up. This suggests that TB stigma can influence TB knowledge among TB patients. It was also supported by Anaam et al. (15) that stigmas are one of the factors significantly influencing knowledge. In Malaysia, despite of having a comprehensive TB control programme, it was reported that Malaysians still have a low level of awareness and knowledge of TB, as well as a high level of social stigma (18). According to Chowdhury et al. (19), stigma continues to be a significant challenge for tuberculosis control programmes across the prevention-to-care continuum. It can also prevent people from getting tested, using care services, or changing their behaviour to prevent disease spread.

However, limited information is available on the direct effect of personal knowledge of TB on the infectious period of the patients. To explore further, a study in Ethiopia had attempted to determine the effect of knowledge of TB to the infectious period of TB patients. Interestingly, the study found that forty percent of the PTB cases in Ethiopia have good knowledge of TB, which was associated with lowering infectious period compared to patients with poor awareness of the disease (20). Many studies have suggested that sputum smear conversion after two months of anti-tuberculosis treatment is an essential determinant of successful treatment and can be a significant predictor for relapse in TB patients (21, 22, 23). In practice, daily doses of anti-TB treatment for two months, which also known as the intensive phase, is an important phase before the patients can continue their treatment into the maintenance phase for another four months towards treatment completion. Hence, the primary aim of this study was to determine the factors influencing the knowledge of TB among smear-positive PTB patients at the end of their intensive treatment. The secondary aim was to determine significant differences in TB knowledge between patients with persistent sputum smear-positivity during the second month of treatment and those negatively converted.

Materials and Methods

Study design and study population

The research design used in this study was cross-sectional study. The study was conducted at the TB clinic in the Institute of Respiratory Medicine (IPR), a TB referral tertiary centre for Klang Valley area which is located at Jalan Pahang, Kuala Lumpur, Malaysia. Smear-positive PTB patients diagnosed between December 2018 and June 2019 were selected as samples. Simple random sampling was applied in enrolling samples in this study based on the sampling frame of PTB smear positive patients attending the clinic. The participants include those smear positive PTB patients tested positive with microscopic sputum smear investigation (at least two positive acid-fast bacilli), adult patients aged 18 years and above, completed 2 months of intensive TB treatment, able to understand and communicate well in Malay language and consented to participate. Patients with other forms of TB were excluded from this study.

Study materials

Standardized self-administered questionnaire

Patients' knowledge of TB was assessed using a set of a pre-tested standardized questionnaire that has previously applied to the TB patients in Omdurman, Sudan. Seven questions were asked to evaluate the knowledge of the disease cause, infectivity, mode of transmission, prevention measures, treatment duration, curability, and the effect of non-compliance (24). TB knowledge was determined by assigning a score for answers received where one point was given for each correct answer. Five correct answers out of seven questions were selected as the cut-off point between satisfactory and unsatisfactory knowledge level (24).

The questionnaire was validated before being used in this study. All questions were reviewed by experts in the area of knowledge to ensure internal validity. Back translation from the English language to Bahasa Melayu and English language was performed by a bilingual experts who are proficient in both the languages to assess the consistency and conceptual equivalence. For

questionnaire face validity check, a pre-test was carried out with ten TB patients who have similar characteristics as the real participants for this study to ensure that the participants can understand the questions easily besides facilitating identification of ambiguous statements or phrases. The output of the pre-test was used to improve the phrases of items in the questionnaire.

Patients' medical record

Patients' medical records were used to obtain information regarding patients' diagnosis, socio-demographic characteristics, clinical characteristics and laboratory results of sputum smear after two months of anti-TB treatment of each participant.

Data collection procedure

The researcher approached the participants during their follow-up treatment in the TB clinic which was scheduled either on Monday or Thursday. To avoid treatment interruption, patients were approached either at the end of their appointment session or during the waiting time. Each of the participants was informed of the study purpose before the commencement of data collection. Upon receiving the patient's permission, a set of self-administered questionnaires was distributed to be answered by each participant which took about ten to twenty minutes to complete.

Ethical consideration

The study procedures were in accordance with the ethical standards of the responsible committee on human experimentation by the Universiti Sains Malaysia Human Ethical Board, and with the Helsinki Declaration of 1975. The patients have their rights to voluntarily participate or withdraw from the study. Oral and written information was provided to all participants before obtaining informed oral and written consents. All data were kept confidential for academic purpose only by not mentioning participants' names, initials or hospital numbers. Ethical approval was received from the Ethical Committee of Universiti Sains Malaysia (USM/JEPeM/19090558) and was registered with the National Malaysian Research Registry.

Data analysis

Data were entered and analyzed using SPSS software version 24.0 for Windows (IBM Corporation, New York, United States). Descriptive data for continuous variables are presented as mean and standard deviation. Meanwhile, descriptive data for categorical variables are presented as frequencies and percentages. For the univariate analysis, simple binary logistic regression was used to analyze the associations and risk measurement between independent variables. Independent variables with a *P* value of less than 0.25 in the univariate analysis were further analyzed using the multivariate model. The multiple binary logistic regression analysis was used to determine the factors that independently associated with unsatisfactory knowledge of TB. The level of significance was specified at 0.05 at a confidence interval of 95%.

Results

Factors influencing knowledge of TB

About 26.0% (n=39) of the smear-positive patients had an unsatisfactory level of knowledge of TB. The univariate analysis findings indicated that the unsatisfactory level of knowledge was significantly influenced by the patients' age, gender, ethnicity, job and level of education. It was found that the odds of having unsatisfactory knowledge increased with an increase of one year of patients' age (crude OR= 1.05, 95% CI= 1.02-1.08). Male PTB smear-positive patients were found to have three times higher odds of unsatisfactory knowledge of TB as compared to females (crude OR= 3.26, 95% CI= 1.18-9.05). Based on ethnicity, the Chinese had nine times higher odds of undesirable knowledge compared to Malay TB patients (crude OR=8.74, 95% CI 3.32-23.03). Employment in the white-collar sector showed 81.0% protection from having unsatisfactory knowledge of TB compared to unemployed patients (crude OR= 0.19, 95% CI= 0.04-0.91).

Meanwhile, patients who received only primary education were 27 times more likely to have unsatisfactory knowledge of TB compared to patients who have received tertiary education (crude OR= 22.04, 95% CI= 2.75-176.82). No significant association was observed between unsatisfactory TB knowledge and patients' compliance with TB treatment during the intensive phase (crude OR= 0.84, 95% CI= 0.33-2.14). Significant independent variables identified after univariate analysis were further analyzed using the multivariable model by multiple binary logistic regression analysis. The final model obtained indicated two factors that were independently related to unsatisfactory TB knowledge which were the gender and ethnicity after controlling factors such as age, gender, ethnicity, job and level of education. The Chinese and immigrant patients were found to have poor knowledge of TB compared to the dominant Malay ethnic in Malaysia (Table 1).

Table 1: Association between socio-demographic characteristics and unsatisfactory knowledge among PTB patients (N=150).

Factors	Satisfactory (n=111) n(%)	Unsatisfactory (n=39) n(%)	Crude OR[a] (95%CI)	Adjusted OR[b] (95% CI)
Age at diagnosis (years)				
Mean ± SD	42.23 ± 12.58	50.00 ± 13.29	1.05 (1.02-1.08)*	1.01 (0.97-1.05)
Gender				
Male	75 (67.6)	34 (87.2)	3.26 (1.18-9.05)*	3.91 (1.09-14.00)*
Female	36 (32.4)	5 (12.8)	reference	reference
Ethnicity				
Chinese	14 (12.6)	17 (43.6)	8.74 (3.32-23.03)*	10.24 (3.03-34.63)*
Indian	17 (15.3)	6 (15.4)	2.54 (0.81-7.96)	2.22 (0.66-7.46)
Immigrant	8 (7.2)	6 (15.4)	5.40 (1.55-18.81)*	4.59 (1.10-19.12)*
Malay	72 (64.9)	10 (25.6)	reference	reference
Marital status				
Married	69 (62.2)	29 (74.4)	0.57 (0.25-1.28)	
Unmarried	42 (37.8)	10 (25.6)	reference	
Job				
Labourer	48 (43.2)	23 (59.0)	1.23 (0.56-2.72)	1.12 (0.37-3.33)
White collar	27 (24.3)	2 (5.1)	0.19 (0.04-0.91)*	0.36 (0.06-2.29)
Unemployed	36 (32.4)	14 (35.9)	reference	reference
Monthly income (RM)				
≤ 750	17 (15.3)	4 (10.3)	1.18 (0.29-4.76)	
751-2000	64 (57.7)	29 (74.4)	2.27 (0.85-6.04)	
> 2000	30 (27.0)	6 (15.4)	reference	
Education level				
Primary	24 (21.6)	23 (59.0)	22.04 (2.75-176.82)*	3.30 (0.24-45.49)
Secondary	64 (57.7)	15 (38.5)	5.39 (0.67-43.13)	1.71 (0.16-18.89)
Tertiary	23 (20.7)	1 (2.6)	reference	reference
Type of case				
New case	88 (79.3)	31 (79.5)	(0.41-2.49)	
Recurrent	23 (20.7)	8 (20.5)	reference	
Treatment compliance				
Non-compliance	23 (20.7)	7 (17.9)	0.84 (0.33-2.14)	
Compliance	88 (79.3)	32 (82.1)	reference	

* statistically significant $p<0.05$, [a] simple logistic regression was performed, [b] multiple logistic regression was performed with forward likelihood ratio method, controlling for age, gender, ethnicity, job, and level of education.

The association of knowledge of TB on sputum smear-positive patients after two months of intensive treatment

Table 2 shows the frequencies of responses to evaluate the knowledge level about TB among patients who have sputum smear non-converted and those who has sputum smear converted in the study. Descriptively, more than half of the patients in both groups (52% of the non-converted and 57.3% of the converted) were aware that germs or bacilli caused TB. Even though the majority of participants (84%) knew that the disease is infectious, only 56% of the patients with non-converted sputum status and 60% of the patients with sputum smear converted were able to identify airborne droplets as the correct mode of transmission for this disease.

Meanwhile, for the prevention of TB, only 60% of the patients with sputum non-converted and 61.3% of the patients with sputum converted were aware of the correct preventive practice. The findings also showed that 84% of patients in both groups were mindful of the right treatment duration and almost all of them agreed that TB is curable and incomplete treatment may lead to prolonged infectiousness, drug-resistant, relapse, and death.

Table 2: Knowledge of TB among patients who were converted and not converted sputum smear status after two-months of intensive TB treatment (N=150).

Items	Non-converted (n=75) n	%	Converted (n=75) n	%	X^2	Adjusted OR[a] (95% CI)	P-value
Causes of TB							
Correct (germs/bacteria)	39	52.0	43	57.3	0.43	1	0.512
Incorrect	36	48.0	32	42.7		1.24 (0.65-2.36)	
Is TB infectious							
Correct (Yes)	63	84.0	63	84.0	0.00	1	> 0.850
Incorrect	12	16.0	12	16.0		.0 0.42-2.39)	
Mode of TB transmission							
Correct (airborne droplet)	42	56.0	45	60.0	0.25	1	0.620
Incorrect	33	44.0	30	40.0		1.18 (0.62-2.26)	
Prevention of TB transmission	45	60.0	46	61.3	0.03	1	0.867
Correct (Wear face mask)	30	40.0	29	38.7		1.06 (0.55-2.04)	
Incorrect							
TB is curable							
Correct (Yes)	73	97.3	75	100.0	2.03	n.a	0.497
Incorrect	2	2.7	0	0.0			
Duration of anti-TB treatment							
Correct (6 months or above)	63	84.0	63	84.0	0.00	1	> 0.850
Incorrect	12	2.7	12	2.7		1.00 (0.42-2.39)	
Incomplete treatment can cause prolonged infectiousness and death							
Correct (Yes)	75	100.0	75	100.0	n.a	n.a	n.a
Incorrect	0	0.0	0	0.0			

[a] Multiple binary logistic regression was performed using forward likelihood ratio method, adjusted for their age, gender, ethnicity, job, treatment compliance and education level, n.a not associated.

However, this study showed that patients' knowledge of the disease did not significantly affect their sputum conversion after two months of intensive treatment, even after their age, race, job, treatment compliance and education level were controlled (Table II). The mean score of knowledge among non-converted patients (5.35±1.40) was slightly lower than that of the converted group (5.47±1.64). Overall, there was no significant difference noted in the knowledge about TB among patients in both groups in this study.

Discussion

Various studies have shown the negative impact of poor knowledge of TB on patients' behavioural measures such as health-seeking behaviour, compliance, and treatment delays. The current study aimed to determine the effect of the patients' knowledge of TB on their sputum smear status after two months of intensive anti-TB treatment (11-13, 25-26). Nevertheless, this study found no significant difference detected in the knowledge of TB between PTB patients regardless of their sputum smear conversion even after controlling confounding factors such as patients' compliance, age, race and gender. The findings were inconsistent with that reported by a prospective cohort study carried out in Ethiopia, which showed a significant influence of knowledge on patients' sputum smear conversion time. According to the study, forty percent of the PTB cases in Ethiopia have good knowledge of TB, which were associated with lowering infectious period compared to patients with poor awareness of the disease (20). The nature of the cross-sectional study design used in this current study may explain the difference in finding compared to the cohort study conducted in Ethiopia. Future prospective studies are needed to confirm the finding.

Approximately 80% of the smear-positive PTB patients in both non-converted and the converted groups were found to have an adequate knowledge of TB which were better compared to a lower knowledge level about the disease in Sudan and India with only 36.2% and 65.0% of the patients, respectively having adequate knowledge on the disease (20, 27). Furthermore, PTB patients participated in the recent study demonstrated a better knowledge of this infectious disease compared to the earlier Malaysian study conducted by Liam et al. (28). A high level of knowledge towards TB among patients in this study could be explained by the consistency of

disease-related health education programme embedded in the TB Directly Observed Therapy short-course (DOTs) management in Malaysia, especially in the regions with high TB prevalence such as Kuala Lumpur (29). Malaysia is among the countries with an intermediate burden of TB that has integrated the Tuberculosis Control Programme into its national public health system back in 1995 and implemented the DOTS strategy in combating TB since 2002. A high-quality TB management has been established and used ever since 2002 (30).

Despite good TB knowledge exhibited by the majority of the patients, there are patients with poor knowledge (26.0%) of this disease. A significant influence of gender factor on the knowledge among PTB patients was noted, which contradicted with another Malaysian study (28). The male patients were found to have a lower knowledge of TB compared to female patients despite equivalent free access to treatment and TB care provided in all TB health facilities in Malaysia. The effect of gender-discriminatory has been explored in a few other studies in international settings to investigate further the interaction between gender and TB (31-33). Qualitatively, it was discovered that females were more aware of available TB related health services and were more frequently engaged with community health promotion initiatives compared to males. Hence, this increased their chances of receiving health promotion information concerning TB in the form of leaflets, posters and educational talks by personnel at the health establishments compared to males (33).

In other respects, this study also found a significant relationship between Chinese ethnicity and immigrants with unsatisfactory knowledge of TB. Malaysia at a glance is a multiracial country in which the citizens comprised of various ethnic groups with Malays being the majority (57.3%), followed by Chinese (23.0%), Indians (6.9%), an indigenous group in Sabah and Sarawak (11.8%) and others (1.0%) (35). For the past five years, Malaysia has been facing the issue of immigrants reflux, which resulted in 9.8% non-Malaysian from the whole year 2019 population. Unfortunately, TB cases among non-Malaysian contributed to 12% to 14% of TB cases in Malaysia (30). It is of concern as many immigrants, and some dominant ethnics showed poor literacy about TB. As a result, this may hinder efforts to prevent the spread of the disease, especially among ageing, low level of education and poor socioeconomic status populations (28, 30, 35).

Overall, although the majority of the patients were aware that TB is infectious, unfortunately, they are less aware on the TB source of infection, the mode of transmission, and the correct practice to prevent the disease transmission. The unsatisfactory knowledge levels in the three critical aspects were in agreement with that reported in previous cross-sectional studies (27, 28, 36). The significant association of knowledge regarding the cause and transmission of TB with TB outcome was seen in an earlier community interventional study done by Dewi et al. (37). This study had shown that low knowledge of TB transmission has negatively impacted the rate of early TB case detection among a population with a history of TB infection in Indonesia. An improvement in the knowledge of TB and the rate of the early case detection were observed following the education activities intervened. The behaviour changes related to prevention of TB were also evident in the intervention community (37). Knowing that the smear-positive PTB patients have higher chances of transmitting the disease besides their poor awareness on the three crucial aspects, it warrants an immediate educational strategy to empower the patients for translation into an effective TB prevention measure at the community level.

Conclusion

This study highlighted a few critical findings related to TB knowledge. Even though the majority of patients showed good knowledge about TB, some patients demonstrated low knowledge in three critical aspects (TB source of infection, mode of transmission and correct preventive measures) which may hinder the efforts in reducing the TB transmission in the community. Besides, the inadequate knowledge of TB was associated with gender and minority ethnics in this study. In line with the End TB strategy, a creative and innovative patient-centred TB educational counselling to cater for male patients and culture-sensitive groups are in demand to equip the patients with a good knowledge of measures to reduce the transmission of the deadly disease in the community.

An aggressive in-reach and out-reach health education programmes with the integration of multiple approaches to counselling are required and should emphasize on the aforementioned three essential areas to complement the existing counselling in the clinics. Besides, further in-depth exploration on the experience of male patients and the minority ethnics on the current TB counselling and their opinion of its impacts on the TB knowledge is needed to assist the health stakeholders in developing a feasible, precise and effective TB education and counselling programme. Knowledge of TB does not play a significant role in patients' smear positivity in the second month of anti-TB treatment in this study. Due to the limitation of incomplete data, this study was unable to assess other important socio-behavioural factors that may mediate the effect of delays in sputum conversion, such as TB diagnosis and treatment delays, the health-seeking behavior, and distance from the place of residence to the treatment center. Besides, the other biological factor such as the drug sensitivity status of the patients was not determined since this testing result will only be available at the fourth or fifth months of TB

treatment by routine practice in the local setting. Inclusion of these factors alongside the TB cognitive factor in future research may help in better explaining the area of interest.

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Competing interests

All authors declare that they had no conflict of interest.

Ethical Clearance

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