

## ORIGINAL ARTICLE

## DEVELOPMENT AND VALIDATION OF THE KNOWLEDGE, ATTITUDE, PRACTICE AND STIGMA QUESTIONNAIRE ON TUBERCULOSIS AMONG YOUNGER POPULATION IN KELANTAN, MALAYSIA

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## ABSTRACT

*There are challenges in controlling TB in Malaysia among young adults. To understand young adults' knowledge, attitudes, practices, and stigma regarding TB, a valid and reliable measurement instrument must be developed and validated. We aim to develop and validate a new questionnaire about knowledge, attitudes, practices, and stigma regarding TB (KAPS-TB) for the young populations in Malaysia. Between the year 2017 and 2020, a cross-sectional study was conducted in two phases to validate KAPS-TB. Phase 1 involved 236 participants from secondary school students in Kelantan and Phase 2 involved 364 students from Health Campus, Universiti Sains Malaysia in Kelantan. KAPS-TB comprised sociodemographic characteristics and KAPS (knowledge, attitude, practice and stigma respectively). The knowledge section was analysed by the two-parameter logistic item response theory. Exploratory factor analysis and confirmatory factor analysis were used to explore the construct and reliability of items for the attitude and stigma sections. Validated KAPS-TB comprised 22, 5, 6 and 11 items on knowledge, attitude, practice and stigma, respectively. Overall, the results showed that each section presented valid and reliable items. KAPS-TB provides a valid and reliable instrument that could also be used to examine the effects of TB health education among the young population and to improve TB prevention and control.*

**Keywords:** questionnaire; validation; knowledge; attitude; practice; stigma; tuberculosis; young population

## INTRODUCTION

Tuberculosis (TB) is an ancient disease that is still prevalent in modern society. It is currently the 13th leading cause of death globally, second only to COVID-19 as the leading infectious killer<sup>1</sup>. The World Health Organisation (WHO) categorised Malaysia as an intermediate burden country for TB, with a notification rate of fewer than 100 cases per 100,000 people<sup>2</sup>.

Malaysia faces many challenges in controlling TB including challenges of control among young adults. Our rationale in focusing on young adults is based on a national study as it revealed that children and adolescents accounted for 8.5% of tuberculosis cases with a high incidence of tuberculosis reported among children of the age group from 10 to 19 years<sup>3</sup>. Unfortunately, studies among this group revealed that while their awareness and knowledge is low, their negative stigma about tuberculosis is high<sup>4-8</sup>. Young adults are also highly mobile and are highly involved in congregate settings such as school, colleges, or higher institutions, therefore this group is at risk for TB transmission<sup>9</sup>. All these factors posed a great challenge for TB control programs across the spectrum between prevention and care<sup>10-11</sup>.

Scientific research and innovation are critical components of the WHO's "End of Tuberculosis" strategy<sup>12</sup>. Pillar III of this strategy emphasizes the critical role of research in optimizing TB control programs, and knowledge, attitude, and practice (KAP) research have been the primary educational intervention strategy for increasing adherence to anti-tuberculosis treatment and thus contributing to TB control. WHO published a guideline for conducting a KAP survey in 2008 to aid in the fight against TB<sup>13</sup>. In research studies, the questionnaire is the most frequently used tool for evaluating KAP scores<sup>14</sup>. Individuals with elevated KAP levels are more capable of preventing and controlling illness, responding to medical treatment, and improving their health<sup>15-19</sup>.

Individuals with tuberculosis often suffer from health-related stigma and the social burden of illness. Health-related stigma is defined as a social process or related personal experience characterized by exclusion, rejection, blame, or devaluation that results from experience or reasonable anticipation of an adverse social judgment about a person or group identified with a particular health problem<sup>15</sup>. Stigma remains a significant challenge for TB control programs across the prevention-to-care continuum. Stigma

can prevent people from getting tested for TB, from using care services, and from changing their behaviour to avoid the spread of TB.

We must gain an understanding of young adults' knowledge, attitudes, practices and stigma regarding TB. To do that, we need a valid and reliable measurement instrument that can be used to measure these domains. Furthermore, such an instrument can be used to investigate, monitor and evaluate the effects of current or planned TB training programs aimed at developing more knowledgeable young adults with positive attitudes and stigma toward TB. To our knowledge, however, such instruments are very limited and have not been widely published yet.

Therefore, this study pursues the development and validation of a new knowledge, attitude, practice and stigma questionnaire on TB to be used by many stakeholders in TB prevention and control programs in Malaysia especially among young adults.

## METHODS

### Study Design and Participants

Two cross-sectional studies were conducted in two phases for validating the new knowledge, attitude, practice and stigma questionnaire on TB between the year 2017 and 2020. In Phase 1, participants aged between 14 and 16 were involved. The study was conducted in two secondary schools in two districts in Kelantan between July and November 2017. This was followed by Phase 2 of the study, in which participants aged between 22 and 28 were involved. The study was conducted in Health Campus, Universiti Sains Malaysia between December 2019 and February 2020.

Regarding the sample size, for the Exploratory Factor Analysis (EFA), a total of 150 to 200 samples is recommended to be the optimum sample size<sup>20-21</sup>. For the Confirmatory Factor Analysis (CFA), the minimum recommended sample size is 200<sup>22</sup>.

### Measurement Tool

#### *Questionnaire development*

This study develops and validates a new knowledge, attitude, practice and stigma questionnaire on TB in the Malay language. It comprised two phases, which were the development phase and the validation phase. The initial development was constructed based on a survey among secondary schools in Kelantan (unpublished study) and content from the Center for Disease Control and Prevention (CDC)<sup>23-25</sup>. The TB stigma part was translated and modified from TB and HIV / AIDS-related stigma scales by Van et al<sup>8</sup>.

The initial construct questionnaire consists of 53 items that cover the four domains of knowledge,

attitude, practice, and TB stigma. The knowledge section includes questions about TB's aetiology, transmission, risk and complications as well as its symptoms. The attitude section of the questionnaire addresses people's attitudes toward the disease and toward those who have TB.

#### *Content validation*

Then, the questionnaire was subjected to a content validity assessment by conducting three sessions of discussion among the experts. Six experts from the field of health education, respiratory, epidemiology, family health and public health contributed to the content validity processes. Clearness, accuracy, and interpretability of the items were the criteria used by the panel in making their selections. Moreover, this panel helped identify new and important information missing from the questionnaire and/or remove non-relevant information from the questionnaire. The content validity (relevance, coverage, and representativeness) of the items in the questionnaire was determined by their extensive expertise in the field. The questionnaire was revised based on the feedback and responses gathered.

Six of the nine drafted items for the first domain, TB prevention practice, were selected. Three items were dropped because they were not directly related to the prevention of the disease, but our concern rests more on the spreading once it has already occurred. All 25 items and 11 items for the second and fourth domains, TB knowledge and stigma, were selected by experts based on clinical relevance. As part of the third domain, attitudes toward TB disease and people with TB, five of the eight drafted items were selected. Three items were omitted because the items were considered to be irrelevant.

The reconciliation of the proposal questionnaires has resulted in a few minor modifications. The phrase "I will go to the clinic or hospital if I have a prolonged cough" was changed to "I will go to the clinic or hospital if I have a cough lasting more than two weeks" for better clarity and specificity in the practice section. In the knowledge section, the phrase "Having a night sweat during the evening or night-time" was changed to "Having sweat during the evening/night-time", and the word "Tibi" was changed to "TB."

As a result, 6 items for the practice domain, 25 items for the knowledge domain, 5 items for the attitude domain and 11 items for the stigma domain were selected for this study.

#### *Face validation*

The preliminary questionnaire was finally administered to 10 undergraduate students to determine its construct validity and reliability. Before an assessment, all volunteers provided written informed consent. They evaluated the

clarity of the instructions, response format, and questionnaire items. Participants were then asked to describe and evaluate each questionnaire item following the open-ended discussion. Their varied responses and comprehension of the questions, the questionnaire's layout and setting, and their lack of ambiguity were all evaluated. Following that, modification was made to the font size and clarity of the question instructions, and a finalised version of the questionnaire was created for use throughout the rest of the research.

The questionnaire consists of four major sections (excluding the socio-demographic data): Section A, B, C and D. Some modifications have been made to the original version to suit the study subject and objective of the study. The socio-demographic data consisted of 10 items: age, gender, ethnicity, program, year of education, smoking/ vaping status, usage of substance abuse and history of TB. In Section A, the questionnaire consisted of 6 items regarding practice against tuberculosis infection with a Likert scale statement containing a score of 2 if 'Almost All Time', 1 if 'Occasionally' and 0 if 'Never'. Section B asked about the knowledge of TB and has 3 subdomains which are 11 items on TB disease, 9 items on symptoms, and 5 items on the preventive measures on TB. This section is made of closed-ended questions. In Section C which comprised 5 items., the questionnaire focused on the attitude of undergraduate students toward TB disease. In this section, Likert scale statements would be applied with a score of 5 if 'Strongly Agree', 4 if 'Agree', 3 if 'Neutral', 2 if 'Disagree' and 1 if 'Strongly Disagree'. Lastly, in Section D, questions looked into the public's view of TB disease (stigma). In this section, there were 11 items with a similar Likert scale to the attitude section which is a score of 5 if 'Strongly Agree', 4 if 'Agree', 3 if 'Neutral', 2 if 'Disagree' and 1 if 'Strongly Disagree'.

#### *Data Collection Procedure*

Phase 1: All Form Four students also two classes from Form Two were selected as suggested by the teachers. The parental consent and youth assent forms were distributed several days earlier to the students with a brief explanation of the study by the investigator. All students from each selected classroom were invited by teachers to voluntarily participate and those who consented were included in study. Open label was applied as it was not possible to blind the respondents, school administrative staff members and investigators.

Phase 2: The researcher explained the purpose of the study to the participants and sought informed consent. The participants were acknowledged

that their participation is voluntary, and they were asked to complete a self-administered questionnaire which takes approximately 10-15 minutes to complete. Upon completion, the survey questionnaire was collected by the researcher.

#### **Statistical analysis**

Data were analysed using IBM SPSS Statistics version 25.0 and R version 4.0.4<sup>26</sup> using the R Studio environment version 2023.3.0.386<sup>27</sup>. The following R packages were used: psych version 2.0.12<sup>28</sup>, ltm version 1.2-0<sup>29</sup>, lavaan version 0.6-7<sup>30</sup>, semTools version 0.5.4<sup>31</sup> and semPlot version 1.1.2<sup>32</sup>. The knowledge section was analysed by the two-parameter logistic item response theory (2-PL IRT) analysis. The attitude and stigma sections were analysed by the exploratory factor analysis (EFA) and confirmatory factor analysis (CFA) respectively in Phase 1 (to explore internal structure) and Phase 2 (to confirm internal structure) of this study. The practice section was analysed descriptively following the recommendation by Zahiruddin et al<sup>33</sup>.

For the 2-PL IRT, a difficulty value in the range of - 3 to + 3 and a discrimination value in the range of 0.35 to 2.5 were considered acceptable<sup>34-35</sup>. The uni-dimensionality assumption was determined by the modified parallel analysis<sup>36</sup>.

For the EFA, the number of extracted factors was determined by the eigenvalues > 1.0 rule, scree plot inspection, parallel analysis, and very-simple-structure method. The EFA was then performed by the principal axis factoring method with the oblimin rotation. Factor loadings > 0.4 were accepted for item selection<sup>37</sup>.

For the CFA, the model fit assessments are based on the following fit indices and their respective cut-off values<sup>38-39</sup>: chi-square ( $\chi^2$ )  $p > 0.05$ , a comparative fit index (CFI) and Tucker-Lewis fit index (TLI) close to or more than 0.95, a root mean square error of approximation (RMSEA)  $\leq 0.08$ , and a standardized root mean square residual (SRMR)  $\leq 0.08$ . For reliability, Cronbach's alpha (for IRT and EFA) and Raykov's rho (for CFA) were used, with the value  $\geq 0.65$  (Cronbach's alpha)<sup>40</sup> and  $\geq 0.7$  (Raykov's rho)<sup>41</sup> considered acceptable.

## **RESULTS**

### **Demographic profile**

A total of 236 and 364 respondents were involved in Phase 1 and Phase 2 respectively. The response rate for both phases was 100%. Their profiles are described in Table 1.

**Table 1: Demographic profile of respondents for Phase 1 (n =236) and Phase 2 (n = 364)**

Variable	Phase 1 n (%)	Phase 2 n (%)
Age (years) <sup>a</sup>	15.4 (0.92)	23.0 (1.11)
Gender		
Male	98 (41.5)	91 (25.0)
Female	138 (58.5)	273 (75.0)
Ethnicity		
Malay	223 (94.5)	250 (68.7)
Non-Malay	13 (5.5)	114 (31.3)
Smoking status		
Yes	19 (8.1)	3 (0.8)
No	217 (91.9)	361 (99.2)
Vaping status		
Yes	24 (10.2)	5 (1.4)
No	212 (89.8)	359 (98.6)
Substance abuse		
Yes	1 (0.4)	2 (0.5)
No	235 (99.6)	362 (99.5)

**Knowledge**

Table 2 shows the result of the IRT analysis for the revised model of Knowledge. In Phase 1, all items were carried forward to Phase 2 because all difficulty and discrimination values fell within the cut-off points, with the exception of B3pre with a difficulty value of 4.058, which was slightly above the cutoff of +3. Although the reliability values were all below 0.7, as Phase 1 was the exploratory stage, reliability was not taken into consideration. In Phase 2, three items were removed, namely B3pre, B8pre and B25pre. In section 1, item B3pre (difficulty = -31.54) and B8pre (difficulty = 7.08) were removed because they were too difficult. Item B11pre was kept in the model although it has low discrimination (Discrimination = 0.13) because the

content was considered important. In section 2, difficulty and discrimination values for all items were satisfied and in range. Thus, all of them were kept in the model. In section 3, item B25pre (difficulty = 21.20) was removed because it was difficult (>+3). Item B21pre (discrimination = 42.58) and B23pre (discrimination = 18.76) had very high discrimination values. However, both items were kept, considering that their difficulty values were within acceptable range and the content was deemed important. As for the reliability, all sections had good reliability with  $\alpha \geq 0.65$ .

Descriptive analysis of items for Knowledge in Phase 1 is provided in **Appendix A**.

**Table 2a: 2PL-IRT analysis for Knowledge for Phase 1 (n =236) and Phase 2 (n = 364)**

Section 1	Pengetahuan Tentang Penyakit TB (Knowledge About TB Disease)	Phase 1			Phase 2		
		b	a	$\alpha$	b	a	$\alpha$
<b>B1pre</b>	<i>TB adalah satu penyakit berjangkit</i> (TB is an infectious disease)	-0.850	0.674	0.563	-2.465	2.900	0.683
<b>B2pre</b>	<i>TB disebabkan oleh kuman</i> (TB is caused by germs)	-1.423	1.322		-1.942	2.180	
<b>B4pre</b>	<i>Paru-paru adalah bahagian badan yang paling kerap diserang TB</i> (The lungs are the part of the body most often attacked by TB)	-0.097	0.818		-2.168	4.617	
<b>B5pre</b>	<i>Penyakit TB boleh dirawat</i> (TB disease can be treated)	-1.210	0.635		-1.921	2.425	

Table 2b: 2PL-IRT analysis for Knowledge for Phase 1 (n =236) and Phase 2 (n = 364)

		Phase 1			Phase 2		
Section 1	<i>Pengetahuan Tentang Penyakit TB (Knowledge About TB Disease)</i>						
Item	Item Description	b	a	α	b	a	α
B6pre	<i>TB boleh membawa maut jika tidak dirawat dengan sempurna (TB can be fatal if not treated properly)</i>	-0.872	1.118		-2.386	2.333	
B7pre	<i>Rawatan TB di negara ini percuma (TB treatment in this country is free)</i>	1.483	1.203		-0.211	2.023	
B9pre	<i>Bilangan kes TB di negara ini masih tinggi (The number of TB cases in this country is still high)</i>	0.498	0.825		-0.962	0.932	
B10pre	<i>Orang yang dijangkiti HIV mudah mendapat penyakit TB (People infected with HIV easily get TB disease)</i>	0.934	1.116		-1.654	1.100	
B11pre	<i>Pemakanan yang seimbang boleh mengurangkan jangkitan TB (A balanced diet can reduce TB infection)</i>	-0.026	0.809		2.685	0.133	
Section 2	<i>Tanda dan gejala penyakit TB (The signs and symptoms of TB disease)</i>						
B12pre	<i>Batuk berkahak (Sputum production)</i>	0.739	0.671	0.684	-1.676	0.830	0.745
B13pre	<i>Batuk selama lebih dari 2 minggu (Coughing for more than 2 weeks)</i>	-0.833	1.371		-2.283	2.456	
B14pre	<i>Demam yang berpanjangan (Prolonged fever)</i>	1.129	0.921		-1.363	1.974	
B15pre	<i>Darah dalam kahak (Blood in sputum)</i>	-0.235	1.119		-1.328	2.168	
B16pre	<i>Kehilangan selera makan (Loss of appetite)</i>	-0.018	1.384		-1.390	2.892	
B17pre	<i>Berpeluh di waktu petang/malam (Sweating in the evening/night)</i>	1.593	0.683		-1.104	2.183	
B18pre	<i>Sakit bahagian dada (Chest pain)</i>	-0.487	1.496		-2.461	0.795	
B19pre	<i>Keletihan (Fatigue)</i>	-0.207	1.673		-2.159	2.729	
B20pre	<i>Turun berat badan (Losing weight)</i>	0.203	1.558		-1.685	2.390	
Section 3	<i>Langkah pencegahan penyakit TB (TB disease prevention steps)</i>						
B21pre	<i>Menutup mulut atau hidung jika batuk atau bersin (Cover your mouth or nose if you cough or sneeze)</i>	-1.659	4.804	0.275	-2.422	42.577	0.662
B22pre	<i>Membuka tingkap rumah benarkan cahaya dan udara masuk (Opening the windows of the house allows light and air to enter)</i>	-2.421	0.634		-1.808	1.075	
B23pre	<i>Menjalani pemeriksaan segera jika ada tanda dan gejala Tibi (Undergo immediate examination if there are signs and symptoms of TB)</i>	-2.912	0.990		-2.178	18.762	
B24pre	<i>(Tidak meludah merata-rata (Not spitting all over the place)</i>	-0.805	0.662		-1.972	1.814	

a, discrimination; b, difficulty; α, Cronbach's alpha

**Attitude and Stigma**

Table 3 shows the results of EFA (Phase 1) and CFA (Phase 2) and the relevant reliability coefficients for Attitude and Stigma sections. For the CFA of Attitude, robust maximum likelihood (MLR)

estimator was used because the data were not multivariate normal.

Descriptive analysis of items for Attitude and Stigma in Phase 1 is provided in Appendix A.

**Table 3a: Factor loading, reliability and correlated error in Attitude and Stigma (Revised model)**

Section/ Item	Item Description	Phase 1		Phase 2	
		Factor loading	Cronbach's alpha ( $\alpha$ )	Factor loading	Raykov's rho ( $\omega$ )
<b>Attitude</b>					
C1pre	<i>Sekiranya anda ada tanda dan gejala Tibi, anda akan segera menjalani ujian mengesahkan penyakit Tibi</i> (If you have signs and symptoms of TB, you will immediately undergo a test to confirm TB disease)	0.481	0.419	0.811	0.557
C2pre	<i>Anda tidak perlu menjalani ujian saringan Tibi jika terdapat ahli keluarga yang mengidap Tibi</i> (You do not need to undergo a TB screening test if there is a family member who has TB)	0.393		0.414	
C3pre	<i>Sekiranya ada ahli keluarga anda yang mengidap Tibi, anda akan membantu dalam penjagaan rawatannya</i> (If there is a member of your family who has TB, you will help in the care of his treatment)	0.272		0.564	
C4pre	<i>Pada pendapat anda, seorang perokok boleh merokok semula selepas tamat rawatan TB</i> (In your opinion, a smoker can smoke again after finishing TB treatment)	0.463		0.232	
C5pre	<i>Pada pendapat anda, anda juga boleh dijangkiti TB jika ada ahli keluarga anda yang disahkan TB</i> (In your opinion, you can also be infected with TB if any of your family members diagnosed with TB)	0.227		0.474	
<b>Stigma</b>					
D1pre	<i>Sesetengah orang tidak suka untuk tinggal bersama pesakit Tibi</i> (Some people do not like to live with TB patients)	0.512	0.885	0.735	0.899
D2pre	<i>Sesetengah orang menjarakkan kedudukan mereka dari pesakit Tibi</i> (Some people distance themselves from TB patients)	0.632		0.688	
D3pre	<i>Sesetengah orang berfikir bahawa pesakit Tibi menjijikkan</i> (Some people think that TB patients are disgusting)	0.650		0.630	
D4pre	<i>Sesetengah orang merasa tidak selesa bila berada dekat dengan pesakit TB</i> (Some people feel uncomfortable when they are physically close to TB patients)	0.783		0.762	

Table 3b: Factor loading, reliability and correlated error in Attitude and Stigma (Revised model)

Section/ Item	Item Description	Phase 1		Phase 2	
		Factor loading	Cronbach's alpha ( $\alpha$ )	Factor loading	Raykov's rho ( $\omega$ )
<b>Stigma</b>					
D5pre	<i>Sesetengah orang tidak mahu pesakit TB bermain dengan anak-anak mereka</i> (Some people do not want TB patients to play with their children)	0.730		0.680	
D6pre	<i>Sesetengah orang tidak mahu bercakap dengan pesakit TB</i> (Some people do not want to talk to TB patients)	0.692		0.790	
D7pre	<i>Sesetengah orang akan berkelakuan berbeza terhadap pesakit TB untuk sepanjang hidupnya</i> (Some people will behave differently towards TB patients for the rest of their lives)	0.559		0.682	
D8pre	<i>Sesetengah orang mungkin tidak mahu makan atau minum dengan orang yang berkawan dengan pesakit TB</i> (Some people may not want to eat or drink with people who are friends with TB patients)	0.681		0.748	
D9pre	<i>Sesetengah orang mengelak untuk menyentuh pesakit TB</i> (Some people avoid touching TB patients)	0.704		0.736	
D10pre	<i>Sesetengah orang mungkin tidak mahu makan atau minum dengan saudara-mara pesakit TB</i> (Some people may not want to eat or drink with relatives of TB patients)	0.639		0.745	
D11pre	<i>Sesetengah orang takut kepada pesakit TB</i> (Some people are afraid of TB patients)	0.506		0.721	

Correlated errors: C2pre and C4pre = 0.180, D1pre and D2pre = 0.454, D4pre and D5pre = 0.332, D7pre and D8pre = 0.417, D9pre and D10pre = 0.368, D2pre and D5pre = 0.226

The original full model of Attitude resulted in unsatisfactory TLI and RMSEA values. Factor loadings for C3pre and C5pre were relatively low. This model was revised by including a correlated error between C2pre and C4pre. Both items were negatively worded items, indicating the method effect. The revised model resulted in acceptable goodness-of-fit indices as shown in Table 5. AIC and BIC values for the revised model were lower than the original model, indicating the improvement of the model. However, as shown in Table 4, the revised model has low reliability (Raykov's rho = 0.557). This could be attributed to a small number of items, and low factor loadings for C2pre, and C5pre (Table 3).

The full model for Stigma had good factor loadings (FL > 0.5) for all items, but the goodness-of-fit indices were not satisfied. Therefore, the model

was revised by including five correlated errors (refer to Table 6 footnote). All statements for these items start with "Sesetengah orang...", indicating the need to account for the method effect by including the correlated errors. The revised model had an acceptable model fit, as indicated by CFI, TLI and SRMR (Table 7). AIC and BIC values for the revised model were lower than the full model, indicating the improvement of the model. For the revised model, the factor loadings for all items are high (FL > 0.5) and the model has high reliability (Raykov's rho = 0.899).

#### Practice

Table 5 shows the descriptive analysis of items for the practice section. As mentioned before, for Practice, only descriptive statistics were performed to see the responding patterns.

**Table 4: Comparison of goodness-of-fit indices between the full model and revised model for Attitude and Stigma**

Section	Model	No. of item	CFI	TLI	SRMR	RMSEA (90% CI)	AIC	BIC
Attitude	Full	5	0.929	0.858	0.047	0.092 (0.058, 0.130)	4043.130	4082.102
	Revised*	5	0.975	0.937	0.030	0.061 (0.018, 0.107)	4034.380	4077.249
Stigma	Full	11	0.841	0.801	0.076	0.158 (0.140, 0.176)	8014.655	8100.392
	Revised*	11	0.946	0.924	0.057	0.098 (0.078, 0.118)	7751.110	7856.333

Note: CFI = Robust Comparative Fit Index, TLI = Robust Tucker-Lewis Index, SRMR = Standardized Root Mean Square Residual, RMSEA = Robust Root Mean Square Error of Approximation, AIC = Akaike Information Criteria, BIC = Bayesian Information Criteria

\*Correlated errors between items are considered.

**Table 5: Descriptive analysis of items for Practice in Phase 1 (n =236) and Phase 2 (n = 364)**

Item	Description	Phase 1 n (%) of response			Phase 2 n (%) of response		
		Never	Some times	Always	Never	Some times	Always
A1pre	<i>Saya meludah merata-rata tempat di tempat awam (I spit all over the place in public)</i>	135(57.2)	101(42.8)	0 (0.0)	329(90.4)	32 (8.8)	3 (0.8)
A2pre	<i>Saya melakukan senaman ringan atau beriadah (I do light exercise or recreation)</i>	2(0.8)	208(88.1)	26(11.0)	6(1.6)	247 (67.9)	111 (30.5)
A3pre	<i>Saya menutup mulut atau hidung jika batuk (I cover my mouth or nose if I cough)</i>	5(2.1)	110(46.6)	121(51.3)	3(0.8)	75(20.6)	286 (78.6)
A4pre	<i>Saya menutup mulut atau hidung jika bersin (I cover my mouth or nose if I sneeze)</i>	2(0.8)	78(33.1)	156(66.1)	4(1.1)	62(17.0)	298 (81.9)
A5pre	<i>Saya pastikan cahaya matahari masuk ke dalam rumah (I make sure the sunlight enters the house)</i>	2(0.8)	98(41.5)	136(57.6)	4(1.1)	91(25.0)	269 (73.9)
A6pre	<i>Saya pergi ke klinik atau hospital jika saya batuk berpanjangan melebihi 2 minggu (I go to the clinic or hospital if I have prolonged cough that lasts more than 2 weeks)</i>	55(23.3)	120(50.8)	61(25.8)	36(9.9)	98(26.9)	230 (63.2)



## DISCUSSION

We aim to develop and validate a new questionnaire on the knowledge, attitude, practice and stigma on tuberculosis (KAPS-TB) in Malaysia especially for the use among the young population. In this study, we produced the final version of the KAPS-TB questionnaire consisting of 25 items for knowledge, five items for attitude, six items for practice and 11 items for stigma domains. Overall, the results show that each section presented valid and reliable items.

The KAPS-TB was initially developed by generating new items for the knowledge, attitude, practice and stigma components based on a related existing questionnaire<sup>8,20-22</sup> as well as contribution from the experts. The content validity was ensured by the thorough item development process. The construct validity was analysed by 2-PL IRT for the knowledge component, and by EFA and CFA for the attitude and stigma components. Good results were obtained for the knowledge and stigma components as indicated by related psychometric measures, model fit values and reliability coefficients in Phase 2, which was the confirmatory phase. There were some discrepancies between the difficulty and discrimination values (IRT analysis) and factor loadings (EFA and CFA) between Phase 1 and Phase 2. This was because Phase 1 was meant for the exploration of the potential items, while Phase 2 intended to confirm the results.

Therefore, results from Phase 2 should be taken as the final results for the validation. In addition, we noted lower reliability (Raykov's rho = 0.557) for the attitude component, although we were satisfied with the items' content. This could be attributed to a small number of items, and low factor loadings for some items (C2pre and C5pre) for attitude domains. For both CFA models for attitude and stigma components, correlated errors were added to account for the method effect to improve the models.

Our questionnaire on knowledge is based on the survey questions that we used among secondary school students in 2015. For the validation in 2017, the questionnaire has undergone another construct validity and analysis. Other studies<sup>14, 42-43</sup> develop their KAP questionnaire based on the WHO documents<sup>13</sup>. However, we have noted some similarities between our questionnaire and their questionnaires in the sense that the knowledge on the symptoms and treatment was included. We agree that these are the areas of importance that need to be included.

Our questions in attitude section are concerned with the personal attitude on perceiving the risk and symptoms of having TB, which are similar to the study in Bangladesh. In comparison to the questionnaire by Jiang et al<sup>14</sup> in China among students (CS-TBKAPQ), they focused more on the

attitude towards seeking knowledge regarding TB-related programme and treatment. Meanwhile, in a study conducted in Italy<sup>42</sup> by Di Nuzzo et al, they did not delve into the attitude and practice because of the complexity of the issues.

In the stigma section, our questionnaires were translated and adopted from Van Rie's questions on stigma<sup>8</sup>. However, some wording and phrases were adjusted to make it suitable culturally. The questions explored into the important aspects of the stigma related to self, close family and friends. CS-TBKAPQ did not delve into this aspect and in study by Mahmud et al<sup>43</sup>, some of these aspects are included in the attitude section.

In the practice section, our questionnaire was concerned with the practices that can reduce or prevent the transmission of TB and health-seeking behaviours when symptoms are present, while the CS-TBKAPQ examined practices related to the dissemination of TB knowledge and health-seeking behaviours. Practice was analysed by descriptive statistics only according to the recommendation by Zahiruddin et al<sup>33</sup>. This was because the section intended to evaluate a number of relevant practices on the prevention of TB by each item, and these items were meant to stand alone on their own. The patterns of responding for the relevant practices on the prevention of TB and reducing airborne transmission were as expected by our experts. The final KAPS-TB questionnaire is provided in **Appendix B**.

We acknowledge the limitation in the sampling; the participants were recruited and sampled conveniently among secondary school students and undergraduate students of the Universiti Sains Malaysia in Kelantan, Malaysia, as the questionnaire was intended to be used specifically for the young adult population. Thus, for the generalizability of the tools, cross-validation studies are needed in other young populations within the similar age range for the application of the questionnaire among other communities. These validated tools, however, have been strengthened by conducting IRT, EFA and CFA analyses.

## CONCLUSION

In this study, we develop and validate a new questionnaire namely KAPS-TB, which can be useful as a measure of knowledge, attitude, practice and stigma of TB. The analyses of validity and reliability demonstrated good psychometric properties of the questionnaire. To the best of our knowledge, this questionnaire is the first validated tool available to assess not only knowledge, attitude and practice, but also the stigma on TB among young adults. Therefore, we propose that the questionnaire as a valid and reliable tool which could also be used to examine the effects of TB health education, and as one of

the contributions to improve TB prevention and control.

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#### Competing interests

The authors declare that they have no competing interests.

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#### Additional data and materials

Appendix A: Results of descriptive analysis.

Appendix B: KAPS-TB questionnaire.

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