Razi Med J. 2026;2(2):174-187
https://doi.org/10.69667/rmj.26201
Razi Medical Journal
https://razi.edu.ly/rmj/index.php/hm

Original article

Exploratory Factor Analysis on Validity of the Knowledge, Attitude, and Practice Questionnaire toward Tuberculosis in the English language: A Public Health Research Concern

Muftah Elbahloul*[1,2], Khadija Amer[3], Rehab Eltayeb[4]

[1]*Department of Community and Family Medicine, Faculty of Medicine, Misurata University, Misurata, Libya*
[2]*Department of Community and Family Medicine, Faculty of Medicine, Razi University, Misurata, Libya*
[3]*Department of General Nursing, Faculty of Health Sciences, Misurata University, Libya*
[4]*Department of Community and Family Medicine, Faculty of Medicine, Misurata University, Libya*
Corresponding email. *muftah@med.misuratau.edu.ly*

Abstract
Knowledge, attitude, and practice (KAP) survey data are vital to help plan, implement, and evaluate prevention and control work and have been the leading educational intervention strategy for respiratory disease control across the globe. This study was conducted to determine the validity of the KAP questionnaire on TB through exploratory factor analysis among professional nurses in Libya. A cross-sectional design using a self-administered prepared TB-KAP questionnaire was conducted to explore the validity. A total of 384 questionnaires were distributed to nurses in tuberculosis centres in Libya. The results of exploratory factor analysis revealed that 109 (97.3%) out of the 112 items were acceptable. Kaiser-Meyer-Olkin (KMO) measures of sampling adequacy was 0.85, 0.77, 071 and Bartlett's test of sphericity was significant (c^2= 21400.87), ($p < 0.05$), ($c^2 = 713.73$), $p < 0.05$), ($c^2 = 2673.32$, $p < 0.05$) for knowledge, attitude, and practice, respectively. The questionnaire on TB knowledge, attitudes, and practices was valid and reliable, with good items that enable its use to assess the TB–KAP survey among TB nurses.
Keywords. *Nurses, Libya, Knowledge, Attitude, Practice, Effectiveness, Tuberculosis.*

Received: 29/01/26
Accepted: 25/03/26
Published: 03/04/26

Introduction

Explanatory factor analysis (EFA) is a multivariate statistical method frequently used in quantitative research when a researcher wants to discover how many and what factors influence a variable, to analyze which variables go together, and to assemble common variables into descriptive categories. On the other hand, principal component analysis (PCA) is used to extract the maximum variance from the data set with each component, and thereby reduce a large number of variables into a smaller number of components [1]. Factor analysis also helps examine the correlations among observed variables and models these relationships through one or more latent (unobserved) variables. Essentially, researchers use factor analysis to uncover hidden patterns or dimensions by applying mathematical procedures that group related variables into a smaller number of meaningful categories. This reduction in data complexity enables researchers to focus on key underlying factors rather than numerous individual variables, thereby simplifying interpretation and enhancing analytical clarity [2].

The primary purpose of EFA is to summarize data to easily interpret and understand relationships and patterns of the observed variables in the measurement tool. In other words, the observed variables are regrouped in a limited cluster with fewer latent variables that cannot be observed based on shared variance. By regrouping the observed variables in a limited set, researchers can focus on fewer items that explain the structure, instead of considering too many items that may be unimportant in their studies, and placing these items into meaningful categories (factors) will allow them to easily conduct their studies [3].

The desirability of KAP surveys has increased recently due to some characteristics such as an easy design, fast implementation, quantifiable data, the results are easily interpreted and presented, as well as the generalizability of small sample results to a large population [4]. Some studies link a higher KAP level with efficient management of illness, response to medical treatment, and promotion of one's own health, and a lower KAP level with poor health, inefficient health care use, and a decrease in disease screening rate [5, 6]. Libyans are still at continuous risk of contracting tuberculosis due to the unlawful entry of undocumented immigrants and smugglers from high-TB-prevalent Sub-Saharan Africa who must pass through it when they want to enter the country. According to the rational Sub-Sahara active practice will be achieved when the people have a high level of knowledge and a positive attitude towards behavior [7]. Therefore, having a valid tool for the assessment of TB knowledge, attitude, and practice of TB is necessary

Razi Med J. 2026;2(2):174-187
https://doi.org/10.69667/rmj.26201
Razi Medical Journal
https://razi.edu.ly/rmj/index.php/hm

to control the spread of the disease. Hence, this study is carried out to develop and validate the questionnaire of knowledge, attitude, and practice on tuberculosis, and the findings will hopefully serve as a valid instrument with good items that can be reliably used to assess the knowledge, attitude, and practice among nurses dealing with TB patients in Libya or even in other countries.

Methodology

Study design, setting and period

This was a quantitative descriptive cross – sectional study based on multivariate analysis conducted in Libya over a period of seven months from January to August 2025. Libya. The country is divided into 24 provinces. There are 29 tuberculosis centers located in 23 provinces in Libya with a total of 582 nurses. Due to the large population size, Misurata has 2 TB centers; Tripoli and Aljabel have 3 TB centers each.

Sampling method and sample size

As the effective sample size for factor analysis should be at least 300 [8,9]. To determine the validity of factor structure and individual items, a large sample of the study population is needed [10]. As the target participants of this study were scattered across a wide geographical area, a two-stage sampling technique was used to draw the target sample of nurses from the entire population of TB nurses in Libya. The method consisted of the following two stages: Stage 1: Fifty percent of the TB centres of each stratum were randomly selected. Stage 2: proportionate random sampling (80%) of nurses, as each stratum has the same sampling fraction in proportional stratified random sampling. However, the calculated sample size for this study was 384.

Factor analysis

In order to determine the construct validity of the questionnaire used in the current study, the principal component analysis (PCA) method was applied for component extraction. The components with eigenvalues that were higher than 1 were retained as components. Next, varimax rotation with Kaisar normalization was used to optimize the loading factor of each item on the extracted components. Items with a loading factor of ≥ 0.4 were considered acceptable and were retained, whereas items with a loading factor of < 0.4 were deleted.

Study the instrument and procedures of data collection

A self – administered Arabic version of the questionnaire was used in data collection. The final version was translated into Arabic. The forward and backward translation method was the translation process to validate the linguistic concepts and to preserve the meaning of the developed questionnaire. In addition to demographic data, the questionnaire covered twelve components about TB knowledge, two components for attitude toward TB, and five components related to TB practice. The data were collected directly from employed nurses at selected tuberculosis centres in Libya after explaining the purpose of the study. For more details about the original English language version KAP questionnaire refer to ANNEX (A, B and C).

Ethical approval

The ethical clearance was obtained from the approval authorities of the TB centres and the NCDC section of Libya. Written consent was obtained from the nurses who agreed to participate in this study.

Results

Demographic characteristics of participants

The demographic characteristics of participants are shown in Table 1.

Table 1. Demographic characteristics of participants (n=384)

Razi Med J. 2026;2(2):174-187
https://doi.org/10.69667/rmj.26201
Razi Medical Journal
https://razi.edu.ly/rmj/index.php/hm

Demographic Variable	n (%)
Gender	
Male	84 (21.9%)
Female	300 (78.1%)
Age	
18 - 25 years	75 (19.5%)
26 - 40 years	246 (64.1%)
> 40 years	63 (16.4%)
Educational Level	
Training course certificate	87 (22.7%)
Diploma of nursing	161 (41.9%)
Bachelor of nursing	136 (35.4%)
Residence	
Urban	176 (45.8%)
Rural	206 (53.6%)
Work experience	
< 1 year	48 (12.5%)
1 -5 years	242 (63.0%)
> 5 years	94 (24.4%)

Multicollinearity and Singularity

Multicollinearity occurs when one observed variable can be predicted from the linear combination of other observed variables. In EFA, each observed variable must be associated with one factor only. This variable must have a higher factor loading than the cross-loading. In order to exclude multicollinearity, the *correlation coefficient* should be <0.8 [11]. Based on our results, there was no multicollinearity detected as the correlations between the independent variables were not high ($r < 0.8$) and the variance inflation factors (VIF) were less than 10 (Table 2).

Table 2. Multicollinearity test for independent variables (n=384)

Variables	Gender	Age	Educational level	Residence	Work period	VIF
Gender	1					1.25
Age	0.11*	1				1.04
Educational level	-0.04	0.11*	1			1.13
Residence	0.05	0.-0.01	-0.04	1		1.11
Work period	-0.04	0.05	0.11*	0.09	1	1.08

Factor Analysis

Statistical Package for Social Sciences (SPSS) version 18 was used for the data entry and the data analysis. The factor analysis was done to determine the construct validity of the questionnaire. Sampling adequacy was measured according to Kaiser-Meyer-Olkin (KMO) and Bartlett's test of sphericity [12]. The sample was considered adequate if the KMO value was more than 0.5 and Bartlett's test was significant ($P<0.001$). The Principal Component Analysis (PCA) method for the component extraction was used. Components with Eigenvalues of over one were retained as components. When the assumptions of all items were uncorrelated with each other, the varimax rotation with Kaisar normalization was applied in order to optimize the loading factor of each item on the extracted components. Items with a loading factor of more than plus or minus 0.4 were considered as an acceptable loading factor, and items below 0.4 were deleted.

Exploratory Factor Analysis (EFA) on knowledge components

Razi Med J. 2026;2(2):174-187
https://doi.org/10.69667/rmj.26201
Razi Medical Journal
https://razi.edu.ly/rmj/index.php/hm

In the KAP questionnaire, the 82 knowledge items were subjected to principal component analysis (PCA) with varimax rotation and Kaiser Normalization as a method of exploratory factor analysis (EFA). Several well-known criteria for the factorability of a correlation were used. First, the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy was 0.85, which was above the suggested value of 0.6, and Bartlett's test of sphericity was significant ($\chi^2 = 21400.87$), ($p < 0.05$) (Table 3). Also, the diagonals of the anti-image correlation matrix were all over 0.5, supporting the inclusion of each item in the factor analysis. Furthermore, initial communalities are estimates of the variance in each variable accounted for by all components, and small values (< 0.3) indicate that the variables do not fit well with the factor solution. In the current study, all the initial communalities were above the threshold.

Originally, there were 12 knowledge components in the questionnaire. However, the PCA revealed the presence of 11 knowledge components, as two of the original components were merged (components 5 and 11). The eigenvalues exceeded 1 for all components. The first component included four items about the causes and infectivity of TB and explained 3.38% of the variance. The second component contained six items regarding TB transmission and explained 4.33% of the variance. The third component consisted of 11 items on TB risk factors and explained 7.48% of the variance. In the fourth component, which explained 4.70% of the variance, there were eight items about the clinical features of TB. The fifth component included seven items, four items regarding the sites of the body that are commonly affected by TB, and three items about the possible outcomes of an incomplete treatment course, and explained 3.61% of the variance. The sixth component comprised two items about TB diagnostic tests and explained 2.80% of the variance.

Furthermore, the seventh component was formed by four items regarding the tuberculin skin test and explained 4.44% of the variance. The eighth component comprised four items on the Interferon-Gamma Release Assay (IGRA) test and explained 3.91% of the variance. The ninth and largest component contained 24 items about TB drugs, and this component explained 15.04% of the variance. The tenth component consisted of three items about multidrug-resistant TB and explained 3.13% of the variance. The eleventh and last component, which consisted of six items about TB preventive measures, explained 4.52% of the variance. Thus, altogether, the 11 components explained 59% of the variance. After varimax rotation, the loading factors for all the extracted components were above 0.4, except for two items (69 and 73), which were below 0.4. In addition, cross-loadings occurred among these two items. First, item 69 originally belonged to the component on drug delivery and the treatment of TB, whereas after rotation, it was included in the component on the risk factors of TB. Second, item 73 was initially in the component about the tests used in multidrug-resistant TB, whereas after varimax rotation, it loaded into an independent and non-relative component. Considering the cross-loadings and loading factor values of less than 0.4, the researcher decided to delete them. The details are shown in (Table 4).

Exploratory Factor Analysis (EFA) on attitude components

Firstly, the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy was 0.77, above the suggested value of 0.6, and Bartlett's test of sphericity was significant ($\chi^2 = 713.73$, $p < 0.05$) (Table 3).. The diagonals of the anti-image correlation matrix were all over 0.5, supporting the inclusion of each item in the factor analysis. Initial communalities are estimates of the variance in each variable accounted for by all components, and small values (<0.3) indicate variables that do not fit well with the factor solution. In the current study, all initial communalities were above the threshold. The results of factor analysis on two extracted components revealed that the eigenvalues were greater than 1. The eigenvalues and total variance explained by two components are shown in (Table 5). The results after Varimax rotation showed that the first component, which included four items related to phobia of tuberculosis, explained 29.26 % of the variance, and the second component, which included four items to social stigma, explained 27.20% of the variance. All loading factors were above 0.4. However, the total variance explained by the two components was 56.46 %. The interpretation of the two components was consistent with previous attitude components in the KAP questionnaire.

Exploratory Factor Analysis (EFA) on practice components

The KMO measure of sampling adequacy was 0.71, which was above the suggested value of 0.6, and Bartlett's test of sphericity was significant ($\chi^2 = 2673.32$, $p < 0.05$ Table3). Also, the diagonals of the anti-image correlation matrix were all over 0.5, supporting the inclusion of each item in the factor analysis. Initial communalities are estimates of the variance in each variable accounted for by all the components and small values (< 0.3). The results after varimax rotation showed that the first component, which included four items regarding the admission protocol for TB patients in wards, explained 12.77 % of the variance. The second component contained five items related to TB infection control measures and explained 12.69 % of the variance.

Razi Med J. 2026;2(2):174-187
https://doi.org/10.69667/rmj.26201
Razi Medical Journal
https://razi.edu.ly/rmj/index.php/hm

The third component included five items related to respiratory hygiene and the collection of sputum and explained 12.10 % of the variance. Component four, which explained 8.956% of the total variance, contained four items related to TB treatment and drug delivery. In the fifth component, there were three items related to patient education about TB, and this component explained 8.467% of the variance. The sixth and last component contained one item related to the collection of sputum samples and explained 2.93 % of the variance. Thus, together, the six components explained a 54.99 % of the variance. All the loading factors were above 0.4. However, item number 15, which had an eigenvalue of 1 (Table 9), was deleted because it became single in component 16 with a non-significant loading of 0.365(Table 6).

Table 3. KMO and Bartlett's Test of Sphericity (SPSS Output)

Factors	Kaiser-Meyer-Olkin Measure of Sampling Adequacy (KMO)	Bartlett's Test of Sphericity
Knowledge	0.85	(χ^2 = 21400.87), ($p < 0.05$).
Attitude	0.77	(χ^2 = 713.73), $p < 0.05$).
Practice	0.71	(χ^2 = 2673.32, $p < 0.05$).

The results of exploratory factor analysis revealed that 109 (97.3%) out of the 112 items were acceptable. After Varimax rotation, the interpretation of the components was consistent with previous components in the TB- KAP questionnaire, except in knowledge, where two of the previous components were merged. However, there were only three items deleted: two items from knowledge components and one item from practice components. Table 8 shows the details of the deleted item

Table.4: Factor loadings based on PCA with varimax rotation for 82 knowledge items

Knowledge Items	Components		
	C1	C2	C3
KN1	0.83		
KN3	0.81		
KN2	0.69		
KN4	0.42		
KN7		0.68	
KN10		0.65	
KN9		0.58	
KN5		0.58	
KN6		0.57	
KN8		0.56	
KN14			0.74
KN21			0.72
KN12			0.72
KN17			0.70
KN19			0.68
KN20			0.66
KN15			0.65
KN16			0.64
KN13			0.57
KN18			0.57
KN11			0.54
KN69			0.35
Eigenvalues	2.77	3.55	6.13
% of Variance	3.38%	4.33%	7.48%

Table 4:(continued,,,,,,)

	C4	C5	C6	C7
KN28	0.69			

Razi Med J. 2026;2(2):174-187
https://doi.org/10.69667/rmj.26201
Razi Medical Journal
https://razi.edu.ly/rmj/index.php/hm

KN27	0.69			
KN26	0.68			
KN29	0.66			
KN24	0.66			
KN25	0.60			
KN22	0.56			
KN23	0.56			
KN33		0.62		
KN74		0.59		
KN32		0.59		
KN76		0.59		
KN30		0.53		
KN31		0.51		
KN75		0.50		
KN35			0.67	
KN34			0.61	
KN38				0.79
KN39				0.74
KN36				0.74
KN40				0.62
KN37				0.62
KN73				0.33
Eigenvalues	3.85	2.96	2.30	3.64
% of Variance	4.70%	3.61%	2.80 %	4.44%
	C 8	**C9**		
KN41	0.80			
KN43	0.76			
KN42	0.63			
KN44	0.53			
KN49		0.84		
KN47		0.78		
KN50		0.76		
KN48		0.74		
KN55		0.70		
KN59		0.69		
KN63		0.68		
KN54		0.68		
KN58		0.66		
KN66		0.64		
KN60		0.64		
KN57		0.61		
KN67		0.60		
KN61		0.60		
KN64		0.58		
KN51		0.58		
KN45		0.57		
KN52		0.57		
KN53		0.56		
KN46		0.54		

Razi Med J. 2026;2(2):174-187
https://doi.org/10.69667/rmj.26201
Razi Medical Journal
https://razi.edu.ly/rmj/index.php/hm

KN62		0.54		
KN65		0.52		
KN56		0.51		
KN68		0.50		
Kn69		0.38		
Eigenvalues	3.20	12.34		
% of Variance	3.91%	15.04%		
	C10	**C11**		
KN72	0.76			
KN70	0.76			
KN71	0.70			
KN73	0.38			
KN80		0.89		
KN79		0.82		
KN81		0.77		
KN77		0.73		
KN82		0.66		
KN78		0.55		
Eigenvalues	2.56	3.71		
% of Variance	3.13%	4.52%		
	Total Variance Explained =59.79%			

Table 5: Factor loadings based on PCA with varimax rotation for 8 items related to attitude

Attitude items	**Attitude Components**	
	Phobia of TB	Stigma of TB
I wouldn't feel comfortable being near a tuberculosis patient	0.84	
I wouldn't want to be in prolonged contact with a TB patient for safety	0.81	
If I had TB, it would be a problem to find a marriage partner	0.70	
I would leave my job if I got TB	0.60	
If I found out that I had TB, I would feel ashamed and embarrassed		0.75
If I had TB, others would think less of my family		0.73
I am worried that others might laugh at me if I get		0.68
I would hide my TB if I got it		0.64
Eigenvalues	2.34	2.17
% of Variance	29.26 %	27.20 %
Total variance explained = 56.46 %		

(Accepted loading factor>0)

Table 6: Factor loadings based on PCA with varimax rotation for 22 items toward practice

Items	**Practice Components**					
	C1	**C2**	**C3**	**C4**	**C5**	**C6**

Razi Med J. 2026;2(2):174-187
https://doi.org/10.69667/rmj.26201
Razi Medical Journal
https://razi.edu.ly/rmj/index.php/hm

P 2	0.83					
P 1	0.78					
P 4	0.75					
P 3	0.65					
P 5		0.84				
P 9		0.83				
P 6		0.70				
P 8		0.65				
P 7		0.55				
P 10			0.87			
P 13			0.77			
P 12			0.68			
P 14			0.64			
P 16				0.71		
P 18				0.70		
P 17				0.58		
P 19				0.51		
P 20					0.82	
P 21					0.77	
P 22					0.55	
P15						0.36
Eigenvalues						
	2.81	2.79	2.63	1.97	1.86	1
% of Variance						
	12.77	12.69	11.10	8.95	8.46	2.93
Total Variance Explained =54.99 %						

P=practice, C = component, refer to (Table 3) for practice items & components details, (Accepted loading factor>0.4)

Table 7. Deleted items based on exploratory factor analysis

Item	Its number and Original Component in the Questionnaire	Reasons of Deletion
Patients do not need to continue medical treatment when the symptoms of tuberculosis subside or when they feel better.	(69) knowledge component 9 about drugs and treatment of TB	• Low loading <0.4 • Cross-loading into nonrelative and independent components
Renal function test.	(73) knowledge component 10 about tests used in the monitoring of MDR-TB	• Low loading <0.4 • Cross-loading into non-relative and independent components
I help the patients to collect sputum when they cannot produce sputum.	(15) Practice component 3 toward respiratory hygiene and collecting a sputum sample	• Low loading <0.4 • Single item

Discussion

Razi Med J. 2026;2(2):174-187
https://doi.org/10.69667/rmj.26201
Razi Medical Journal
https://razi.edu.ly/rmj/index.php/hm

Exploratory factor analysis (EFA) is useful in determining the constructs under a given data set and the extent to which these constructs represent the original variables. Besides, EFA can also investigate the correlations between the observed variables. EFA also has the ability to combine the common variables in the dataset into descriptive categories and thus reduce the number of factors. This will lead to shrinking a relatively large set of variables to a smaller and more manageable number while preserving the original variance as much as possible [13].

Ideally, the EFA will function better and give a more stable solution with a larger sample size by reducing the margin of error. In this study, 384 samples have been used for EFA, which is more than 100 samples, which is considered adequate for the EFA as evidenced by the Kaiser-Meyer-Olkin result above 0.6 and the significant Bartlett's test for Sphericity result [14].

Regarding knowledge components, the sample used in the analysis was adequate, as reflected by the obtained Kaiser-Meyer-Olkin (KMO) value of (0.85), which is above the suggested value of 0.6. This finding is consistent with the value of (0.827) obtained in another study [15]. The exploratory factor analysis (EFA) revealed that 109 (97.3%) out of the 112 items were acceptable. After Varimax rotation, the interpretation of the components was consistent with the original components in the TB- KAP questionnaire, except in knowledge, where two of the previous components were merged together. However, there were only three items deleted to low loading (<0.4) and cross loading: two items from knowledge components, item 69 (patients do not need to continue medical treatment when the symptoms of tuberculosis subside or when they feel better), item 73 (use of renal function test in MDRTB), and item [15] from practice components (I helped the patients to collect sputum when they could not produce sputum). This finding varies from the findings of a previous study, where eight items were deleted from the three domains (knowledge, attitude, and practice) [2].

Strengths and limitations of the study

This study has a few limitations; confirmatory factor analysis (CFA) was not used in this study. This instrument was validated to be used among TB nurses and may not be suitable for the assessment of knowledge, attitude, and practice among nurses in non-TB healthcare facilities. A cross-sectional study was chosen in this study, which utilized self-reported data, which was also subject to response bias, limiting the representativeness and generalizability of the results. However, the researcher has employed systematic random sampling to minimize the selection bias and improve the generalizability of the Study. Furthermore, the response rate was high with a large sample size.

Conclusion

The TB -KAP questionnaire demonstrated reliability and adequate content as well as construct validity. It is a valid instrument with good items that can be reliably used to assess the knowledge, attitude and practice among nurses dealing with TB patients in Libya or even in other countries. The finding of the validation process indicated that 109 (97.3%) out of the 112 items were acceptable, and only three items were deleted from the questionnaire. However, the structure and meaning of sentences in the remaining items of the components were still the same as the original questionnaire after exploratory factor analysis.

Authors' Contributions

Conception and design: Muftah Abdulssalam Elbahloul
Collection and assembly of data: Muftah Abdulssalam Elbahloul and Khadija Ali Amer

Acknowledgment

The authors would like to express their sincere thanks to all the nurses who participated in the study. They also convey their sincere thanks to the management of tuberculosis centers for permitting them to carry out the study in these places.

Disclosure.

The authors have no conflict of interest to declare. No funding was received for this study.

References

1. Habing B, editor. Exploratory factor analysis: theory and application [Internet]. 2003 [cited 2020 Apr 22]. Available from: https://www.let.rug.nl/nerbonne/teach/rema-stats-meth-seminar/Factor-Analysis-Kootstra-04.pdf

2. Dalawi I, Isa MR, Aimran N. Exploratory factor analysis on the development and validation of the understanding, attitude, practice and health literacy questionnaire on COVID-19 in Malay language. Sci Rep. 2025;15(1):19654.
3. Bartholomew DJ, Knott M, Moustaki I. Latent variable models and factor analysis: a unified approach. 3rd ed. Hoboken (NJ): John Wiley & Sons; 2011.
4. World Health Organization. Advocacy, communication and social mobilization for TB control: a guide to developing knowledge, attitude and practice surveys. Geneva: World Health Organization; 2008.
5. Launiala A. How much can a KAP survey tell us about people's knowledge, attitudes and practices? Some observations from medical anthropology research on malaria in pregnancy in Malawi. Anthropol Matters. 2009;11(1).
6. Matsumoto-Takahashi ELA, Tongol-Rivera P, Villacorte EA, Angluben RU, Jimba M, Kano S. Patient knowledge on malaria symptoms is a key to promoting universal access of patients to effective malaria treatment in Palawan, the Philippines. PLoS One. 2015;10(6):e0127858.
7. Rana M, Sayem A, Karim R, Islam N, Islam R, Zaman TK, et al. Assessment of knowledge regarding tuberculosis among non-medical university students in Bangladesh: a cross-sectional study. BMC Public Health. 2015;15(1):716.
8. Tabachnick BG, Fidell LS. Using multivariate statistics. 4th ed. Boston (MA): Allyn and Bacon; 2001.
9. Sürücü L, Yıkılmaz İ, Maşlakçı A. Exploratory factor analysis (EFA) in quantitative researches and practical considerations. Gümüşhane Univ J Health Sci. 2022;13(2):947-65.
10. Costello AB, Osborne J. Best practices in exploratory factor analysis: four recommendations for getting the most from your analysis. Pract Assess Res Eval. 2005;10(1):7.
11. UCLA: Statistical Consulting Group. Introduction to SAS [Internet]. Los Angeles (CA): UCLA Academic Technology Services; 2007 [cited 2007 Nov 24]. Available from: https://stats.idre.ucla.edu/sas/
12. Zhang Z, Sangsawang T, Vipahasna K, Pigultong M. A mixed-methods data approach integrating importance-performance analysis (IPA) and Kaiser-Meyer-Olkin (KMO) in applied talent cultivation. J Appl Data Sci. 2024;5(1):256-67.
13. Sürücü L, Yıkılmaz İ, Maşlakçı A. Digital Leadership: A Scale Adaptation Study. Abant Soc Sci J. 2022;22(3):1038-50. Turkish.
14. Suhr DD. Exploratory or confirmatory factor analysis? Cary (NC): SAS Institute Inc.; 2006.
15. Elmi OS, Hasan H, Abdullah S, Jeab MZM, Nadiah WA, Zilfalil B, et al. Development and validation of a questionnaire on the knowledge of tuberculosis and the perception of tuberculosis treatment among tuberculosis patients in Malaysia. [Place of publication unknown]: [publisher unknown]; 2014.

ANNEX A : Details of knowledge items

No	Knowledge items:

Razi Med J. 2026;2(2):174-187
https://doi.org/10.69667/rmj.26201
Razi Medical Journal
https://razi.edu.ly/rmj/index.php/hm

Based on your knowledge about TB -causes and infectivity (component1) ,please check all	
1	The microbe that cause tuberculosis is a bacteria
2	Tuberculosis is considered a serious disease
3	Tuberculosis is a contagious can be spread from one to other
4	The people may become infected with TB more than once in their lifetime
In your opinion, how the person became infected with TB? (component 2) please check all	
5	Through handshakes
6	Through the air when a person with TB coughs
7	Drinking unpasteurized and non-sterile Cow's milk
8	Through sharing the TB-infected person the same plate during eating or the same cup during drinking
9	Through touching items in public places (doorknobs, handles in transportation)
10	Through sexual intercourse
In your opinion, who are the persons most likely to become infected with TB? (component 3), please check all	
11	person with HIV/AIDS
12	Person with poor nutritional state
13	Person who living in Crowding
14	Homeless person
15	Patient with Long hospital admission
16	Health care workers
17	Prison inmates
18	Children under five- years
19	Farmer
20	Family members of a confirmed case
21	Person with occupational lung disease
About TB- symptoms , signs and affected organ, what is/are the main symptom(s) and sign(s) that could be appeared on infected person (component 4), please check all	
22	Cough up blood
23	Coughing for over two weeks
24	Fever for over two weeks
25	Loss of appetite
26	Night sweating
27	Chest pain and shortness of breath
28	Total weakness
29	Weight loss
Other than lungs ,common sites in the body may also affected by TB (component 5) is /are, please check all	
30	Lymph node
31	Kidney
32	Brain
33	Spinal cord
Regarding the diagnosis of TB infection (component 6) ,please check all	
34	Sputum Smear Microscopy and Culture is the gold test for TB-diagnosis
35	Chest X-ray is helpful test for diagnosis of pulmonary tuberculosis

No	**Knowledge items:**
Regarding interpretation of tuberculin skin test (TST), Induration of >5 mm is considered positive for some cases (component 7). Based on your knowledge, please check all	
36	People living with HIV

Razi Med J. 2026;2(2):174-187
https://doi.org/10.69667/rmj.26201
Razi Medical Journal
https://razi.edu.ly/rmj/index.php/hm

37	Recent close contacts of people with infectious TB
38	People with chest x-ray findings of TB disease
39	People with organ transplants
40	Other immunosuppressed patients

In your opinion, what is/are the advantages of Interferon-Gamma Release Assays (IGRA) test (component 8) please check all

41	Results can be available in 24 hours
42	Does not cause booster phenomenon
43	Less likely to have incorrect reading of results as compared to TST
44	BCG vaccination does not affect the results

Regarding TB treatment and delivering of anti -TB drugs (component 9), please check all

45	DOTS regimen is the recommended treatment of newly active TB
46	The standard length of treatment for a newly diagnosed case of TB is ≥6 months
47	Regarding treatment of TB, Hearing loss and ototoxicity is considered side effect of Amikacin
48	Hepatotoxicity is considered side effect of Ethambutol
49	Ethambutol can be taken after meals because it does not interact with foods
50	The nurse should monitor patients consuming ethambutol for vision changes, blurring and colour blindness
51	Dizziness, vertigo, tinnitus, disequilibrium and loss of hearing are among the side-effects of streptomycin
52	Isoniazid, rifampin, pyrazinamide and ethambutol are first-line drugs used in TB- treatment
53	Second-line drug combination used to treat tuberculosis includes prednol, teofilin, ephedrine and isoniazid
54	Direct Observation Therapy Strategy refers to observation of the patient by an educated person while properly consuming all the doses of the drugs
55	Ethambutol can be used for tuberculosis prophylaxis in patients who are at risk
56	Presence of acid-fast bacillus in the sputum samples of patients during the fifth month of medical treatment indicates multi-drug resistance.
57	If the patient did not consume anti-tuberculosis drug daily, the nurse can double the dose the next day
58	The nurse should administer streptomycin through an intramuscular
59	Multidrug resistant tuberculosis (MDR TB) is caused by an organism resistant to both isoniazid and rifampicin
60	The main reason of multi-drug resistance during tuberculosis therapy is use of drug combinations
61	Anti-tuberculosis treatment should be terminated in patients receiving haemodialysis
62	The nurse should explain to women that rifampin might decrease the effects of oral hormone-based contraceptives
63	Patients using rifampin should be monitored for signs and symptoms of anaemia and thrombocytopenia
64	Diabetic patients on rifampin should be monitored for blood-urine glucose level during treatment course
65	Isoniazid might be less effective when used with antacids containing aluminium hydroxide

ANNEX A (continued)

No	**Knowledge items:**

Razi Med J. 2026;2(2):174-187
https://doi.org/10.69667/rmj.26201
Razi Medical Journal
https://razi.edu.ly/rmj/index.php/hm

66	The nurse should explain to mothers of newborns to avoid breast-feeding the baby while on isoniazid therapy
67	If the patient has nausea and vomiting during treatment, the oral form of rifampin can be given in divided doses at different times in a day.
68	Patients with multi-drug resistance should continue therapy with the same treatment regimen drugs for extra one (1) month

In your opinion , which of the following test/tests is/are used in monitoring of MDR-TB treatment (component 10) please check all

69	Sputum smear and culture
70	Liver Function Test
71	Chest X-Ray

What do you consider to be the main risk to the patient associated with incomplete or interrupted treatment course for TB

72	Worsening of symptoms and prolonged treatment course
73	Development of drug-resistance
74	Death

Regarding prevention of TB infection, what do you think are the best ways a person can prevent getting aTB (component 11)?

75	Avoidance of direct contact of TB patient
76	By taking a healthy diet and doing a lot of physical activities
77	By avoiding alcohol and other drug abuse
78	By wearing face mask as Personal protective Equipment (PPE)
79	By living in ventilated residences
80	By vaccination against the disea**se**

ANNEX B: Details of attitude items

No	**1(Strongly agree), 2 (agree) , 3 (Somewhat agree) , 4 (dis agree) , 5 (strongly disagree)**
Items regarding phobia of tuberculosis	
1	I wouldn’t feel comfortable about being near to a tuberculosis patient
2	I wouldn’t want to be in prolonged contact with a tuberculosis patient for safety reasons
3	If I had TB, it would be a problem to find a marriage partner
4	I would leave my job if I got TB
Items regarding social stigma of tuberculosis	
5	If I found out that I had TB, I would feel ashamed and embarrassed
6	If I had TB, others would think less of my family
7	I am worried that others and hospital staff might laugh at me if I got TB
8	I would hide my TB if I got it

ANNEX C : The Detail of Practice Items

Razi Med J. 2026;2(2):174-187
https://doi.org/10.69667/rmj.26201
Razi Medical Journal
https://razi.edu.ly/rmj/index.php/hm

	Items regarding practice
At the admission of TB patients (component1)	
1	I ask the patients during admission about previous history of TB infection
2	I ask patient about any close contact with household members or friends
3	I check the patients' drugs that they have during admission
4	I fill and send the disease notification form to the relevant registration unit
Regarding TB- Infection control measures (component2)	
5	I ask the patients in the ward to always wear the protective mask
6	I wear the protective face mask and gloves while handling the patients
7	I keep the infectious and non- infectious TB -patients in the separate rooms
8	I use separate treating and testing devices for every individual patient
9	I ask the patients to cover their mouth and nose during coughing, or talking
Regarding respiratory hygiene and collecting sputum samples (component3)	
10	I collect sputum specimens from patients in a separate ventilated space
11	I collect the sputum in a pot with lid and then dispose properly
12	I collect the THREE (3) samples of sputum for AFB with fully completed form
13	I explain and follow the sputum collection procedures
14	I explain to the patients how the test to be done and the reason for doing it
During treatment of patient and delivery of anti- TB drugs (component4)	
15	I ensure the correct dosages of drugs during distribution of medications
16	I ask and remind the patients to take their drugs regularly on time
17	I take note of any appeared side effects or allergic reaction of drugs
18	I monitor whether the patients have response or resistance to treatment
Regarding patient education (component5)	
19	I teach the patients about the different aspects of the TB disease
20	I explain to the patients treatment at home and follow up during discharge
21	I call and remind the patients if they missed the follow-up appointment