SYSTEMATIC REVIEW

Tuberculosis in Malaysia: A Systematic Review of Knowledge, Attitudes, and Practices Among Different Communities

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ABSTRACT

Introduction: Tuberculosis (TB) is a highly endemic infectious disease that poses a serious public health problem in Malaysia. **Materials and methods:** This study systematically reviews knowledge, attitudes, and practice (KAP) studies on TB in Malaysia. Searches for eligible primary studies were conducted in the EBSCOHost, MEDLINE, CINAHL, ScienceDirect, Scopus, Web of Science, and UKM Journal Article Repository databases with no time limits in September 2021. Grey literature, reference lists of included studies and Google Scholar were also searched for eligible studies. Three independent authors screened search results, selected studies, and extracted data. The Critical Appraisal Skill Program (CASP) was used to assess the risk of bias in the included studies, focusing on validity, results, and societal value. Two reviewers independently evaluated each study, with a third author resolving any disagreements. **Results:** A total of 16 studies were included, with fifteen, six, and seven articles assessing knowledge, attitudes, and practices regarding TB. Based on CASP, all included studies demonstrated clear aims, findings, and research value. The KAP results vary among the studies; however, KAP on TB was moderate to good in healthcare workers (HCWs), TB patients, and prison workers, while KAP on TB was found to be low to moderate in the community and student populations. Additionally, a high KAP level was attributed to certain socio-demographic factors. **Conclusion:** The finding brings relevant information on TB-related KAP that is useful in developing continuous education, awareness, and prevention strategies in high-risk groups and communities. Reviews also identify gaps in the literature investigating KAP towards TB in other high-risk groups, such as immigrants, prisoners, sex workers, and states with high TB cases.
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INTRODUCTION

Tuberculosis (TB) is a serious and contagious disease caused by Mycobacterium Tuberculosis (MTB). When people with pulmonary TB cough or sneeze, infectious droplets containing MTB nuclei are released into the air, causing the spread of the disease. Once exposed to MTB, the bacterium can remain latent in the infected person's body for months or even years without causing any symptoms (1). Malaysia is a country with an intermediate (TB) burden, with a TB case fatality ratio of 5% (2). A high burden of TB and Multidrug-Resistant TB (MDR-TB) infection reported in the previous systematic review with a vulnerable population of low socio-economic status and behavioural risk factors is at higher risk (3, 4). Therefore, TB is an endemic disease in Malaysia, and it is also a significant public health concern.

Knowledge, Attitude, and Practices (KAP) studies are among the most commonly conducted studies to gather information on what is known, the beliefs, and the specific actions taken concerning general or particular issues in a specific population (5, 6). The KAP level of specific diseases or issues is frequently associated with socio-demographic and socio-economic patterns (7-9). To better understand the communities' understanding of TB, several studies on KAP have been conducted among the populations of interest, including prisoners and TB patients (10-12).

To the best of our knowledge, no reviews have been published synthesising the KAP towards TB in Malaysia. Hence, we designed a study to systematically review the relevant literature on KAP regarding TB conducted in any population in Malaysia. A review by Rajendran

et al. (2020) on the contributory risk factors towards the prevalence of MDR-TB in Malaysia reported that the low knowledge among the community and TB patients might increase the progression of TB into MDR-TB (4). This systematic review is performed by critically synthesising the KAP level for TB in different study settings and evaluating the risks associated with low KAP levels in a previous study conducted in Malaysia. Hence, this review will provide relevant information for developing effective interventions and strategic plans to prevent TB disease in the targeted communities.

MATERIALS AND METHODS

Search strategy

The systematic review was reported using the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) criteria (13). Figure 1 summarises the detailed framework. Using database-specific queries, articles were retrieved from MEDLINE, CINAHL®, PsycINFO®, PubMed Central®, ScienceDirect®, Scopus, UKM Journal Article Repository, and Web of ScienceTM on 4th September 2021. Our searches used both controlled and free-text languages. For free-text searches, the keywords were (knowledge OR attitude* OR practise*) AND (tubercul* OR TB OR TB) AND (Malaysia*). The controlled language search included the following explored Medical Subject Headings (MeSH) terms: "health knowledge," "attitudes," "practice," "TB," and "Malaysia," as recommended for each database. We also searched Google Scholar for unpublished data in the grey literature. Finally, we manually searched the identified articles' reference lists.

Study selection: eligibility criteria

The study inclusion criteria were any study population conducted in Malaysia with KAP on TB's study outcome. The exclusion criteria were studies that did not make the results explicit for each KAP domain, qualitative analysis, articles in non-English or non-Malay, or review articles.

Study selection

Initially, three review authors independently screened the retrieved articles, screening for relevant titles and abstracts (ZI, MI, and LHM). The review authors then screen the full-text articles based on the inclusion/exclusion criteria. Disputes were resolved by consensus among all reviewers. Note that only one study's data is included if two studies have the same authors or overlapping enrollment dates. The study with the most evidence, respondents, and detailed primary outcome reporting was chosen (14).

Data abstraction and synthesis

The research question for this systematic review is: What are the knowledge, attitudes, and practices regarding tuberculosis among different populations in Malaysia, as identified in existing studies?. Data to answer this research question were independently extracted by three reviewers (ZI, MI, and LHM) from the eligible studies. Data extracted from each study included:

1. Study characteristics: Authors, year of publication, period of study, place of study, type of respondents, sampling size, gender, and age.
2. Description of survey characteristics: Type of survey, number of questions, and instrument of validation.
3. KAP Results: Knowledge, attitudes, and practices outcomes (including aetiology, modes of transmission, prevention, and treatment) and any factors influencing these outcomes.

None of the articles were published in Malay, even though we did not limit the search to English-language articles. Therefore, no articles required English translations.

Quality assessment

The Critical Appraisal Skill Program (CASP) assessed the studies' risk of bias (15). This tool used ten questions to determine three broad issues that should be considered when evaluating a report:

1. Are the results of the review valid?
2. What are the results?
3. Will the results contribute to our society?

Two reviewers reviewed each study independently (i.e., yes, no, or vague). Consequently, a third author arbitrated disagreements once the risk of bias assessments was compared.

Quantitative data analyses

The high level of heterogeneity in the scoring systems used across studies can impact the synthesis of findings by limiting the ability to draw direct comparisons between studies. This variability means that combining the data for a pooled statistical analysis or meta-analysis is not possible, as the differences in methods could lead to misleading or inaccurate conclusions. Consequently, the synthesis of findings relies on a narrative overview, which can offer valuable insights but may not provide the same level of quantitative strength or generalizability as a pooled analysis.

RESULTS

Selection process

Our search yielded 802 records across databases and grey literature. After removing 31 duplicates and 12 records flagged as unsuitable by automation, 727 records were excluded based on title and abstract eligibility criteria. Out of 17 potentially eligible returned full-text records, 16 papers met our inclusion criteria, and one study was excluded as the study was not conducted in Malaysia (16). Figure 1 summarises the record search and screening.

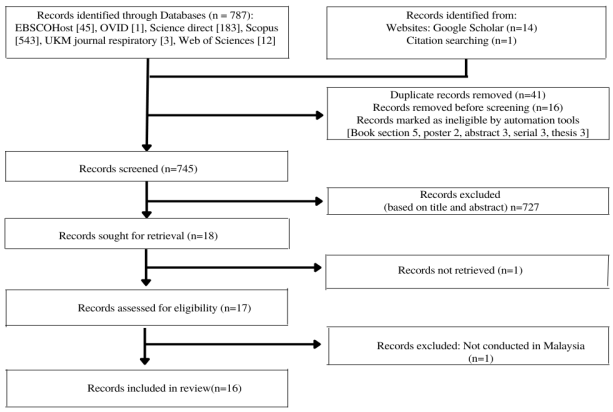

Figure 1: Flow diagram of searched article

Quality assessment

Overall, all studies had adequate data to answer the research question. Table I summarises the quality of the studies included. Based on the CASP that assessed the studies' risk of bias, all the included studies have clear study aims, findings, and research value.

General characteristics of included studies

Table II summarises the studies' main characteristics. Except for Idris et al. (25), all 15 studies used a cross-sectional design. A total of 4,226 respondents were studied, with a mean of 412.69 ± 433.17 and 75–1587 respondents per study.

Methodologies of included studies

Table III summarises the KAP survey methods. Fourteen studies employed self-administered questionnaires (87.5%), while two used face-to-face interviews (12.5%). Meanwhile, two of the studies did not specify the number of questions (20, 21). Early studies by Liam et al. (17) and Mokhtar et al. (18) did not specify the instrument of validation used in their research.

Main findings

Table IV summarises the major findings and the factors associated with higher KAP towards TB from the studies included in the systematic review. The surveys used disparate scoring systems and study instruments, thus preventing precise and unambiguous comparisons between the studies. Samples with a variety of population settings were studied in the included articles. Therefore, this review synthesises the KAP domain based on the study populations as described below.

Table I: Risk of bias graph of review authors' assessments of each risk of bias item in all included studies.

Author (s)	Clear study aim	Methods suitability	Design suitability	Sampling suitability	Data collection quality	Instrument reliability	Ethical issued	Data analysis intensity	Clear findings	Research value
Liam et al., 1999 (17)	Yes	Vague	Vague	Vague	Yes	No	No	Yes	Yes	Yes
Koay, 2004 (18)	Yes	Vague	Vague	Vague	Yes	Vague	No	Yes	Yes	Yes
Mokhtar et al., 2012 (19)	Yes	Vague	Yes	Yes	Yes	No	No	Vague	Yes	Yes
Nawawi & Rahman, 2015 (20)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sanusi et al., 2017 (21)	Yes	Vague	Yes	Yes	Yes	Vague	Vague	Vague	Yes	Yes
Haque et al., 2018 (10)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Mohd Salleh et al., 2018 (22)	Yes	Vague	Vague	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Jamaludin et al,, 2019 (23)	Yes	Vague	Yes	Yes	Yes	Vague	Yes	Yes	Yes	Yes
Selvaganapathi et al., 2019 (24)	Yes	Vague	Yes	Yes	Yes	Yes	Yes	Vague	Yes	Yes
Idris, et al., 2020 (25)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Mokhtar & Rahman, 2020 (26)	Yes	Vague	Yes	Vague	Vague	Yes	Yes	Yes	Yes	Yes
Mokhtar et al., 2020 (11)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Ramlan et al., 2020 (8)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Shahbuddin et al., 2020 (27)	Yes	Yes	Yes	Yes	Yes	Yes	Vague	Vague	Yes	Yes
Zaki et al., 2020 (28)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Geok et al., 2021 (12)	Yes	Yes	Yes	Yes	Vague	Yes	Yes	Vague	Yes	Yes

Table II: General description of studies included in the systematic review

References	Sampling time	Study area/ District	Study population	Sample size	Gender (%)	Age (years)
Liam et al., 1999	September 1994 –February 1996	University Hospital in Kuala Lumpur	Patients commenced on anti-tuberculosis chemotherapy	135	Male: 58.5% Female: 41.5%	41.9 ± 17.4
Koay, 2004	24 December 1996	Kudat, Sabah	General Public	205	Male: 50.7% Female:49.3%	36.1 ± 9.8
Mokhtar et al., 2012	March 2012	Universiti Sains Malaysia, Penang	Public university students	400	Male: 45.3% Female: 54.8%	Not declared
Nawawi & Rahman, 2015	Not declared	Kajang, Selangor	General Public	384	Male: 44.0% Female:56.0%	18-39:78.1% 40-49: 21.9%
Sanusi et al., 2017	Not declared	UTHM, Johor	Public university students	270	Male:59.3% Female: 40.7%	Not declared
Haque et al., 2018 (10)	November 2017 - April 2018	Tapah Prison, Perak	Prison workers	100	Male: 61.0% Female:39.0%	18-45: 91.0%, > 46: 9.0%
Mohd Salleh et al., 2018	21 January - 1 February 2014	Kulim, Kedah	General Public	102	Male: 32.4% Female: 67.6%	38.91 ± 13.24
Jamaludin et al,, 2019	Not declared	IIUM, Pahang	Public university students	324	Male: 28.4% Female:71.6%	Not declared
Selvaganapathi et al., 2019	January - June 2019	Seremban Prison, Negeri Sembilan	Prison workers	280	Male:86.3% Female:13.7%	21-40: 69.0% > 41: 31.0%
Idris, et al., 2020	July 2017	Secondary schools in Pasir Mas and Pasir Puteh, Kelantan	Secondary school students	236	Male: 41.5% Female:58.5%	14: 29.7% 16: 70.3%
Mokhtar & Rahman, 2020	May 2014 - March 2015	Penang, Kuala Lumpur, Selangor, Kelantan, Johor, Sabah, Sarawak	Registered TB patients	1587	Male: 59.5% Female: 40.5% No answer:0.9%	< 51: 69.9% ≥51: 30.1%
Mokhtar et al., 2020	May 2014 -March 2015	Penang, Kuala Lumpur, Selangor, Kelantan, Johor, Sabah, and Sarawak	Registered TB patients	1368	Male: 60.2% Female: 39.0%	<40: 52.2% ≥ 40 :47.8%
Ramlan et al., 2020	2017	Primary healthcare facilities	Healthcare worker	320	Male:21.9% Female: 78.1%	Median (IQR): 31 (9.0)
Shahbuddin et al., 2020	November 2014-February 2015	Hospital Ampang, Selangor	Healthcare worker	75	Male: 24.0% Female: 76.0%	<40: 94.6% ≥ 40: 5.4%
Zaki et al., 2020	February - October 2016	Public healthcare facilities in Selangor	Healthcare worker	465	Male: 27.1% Female: 72.5%	33.2 ± 5.1
Geok et al., 2021	Not declared	Kg Pandan, Kuala Lumpur	General Public	352	Male: 49.1% Female: 50.9%	Mean age: 48.08 ± 16.84

Table III: Description of surveys characteristics of included studies

References	Type of survey	Number of questions	Instrument of validation	KAP analysis
Liam et al., 1999	Face to face interview	6-knowledge	Not specified	Frequency (%). Inferential analysis
Koay, 2004	Face to face interview	24-knowledge, 7-attitude	Literature review	Frequency (%). Inferential analysis
Mokhtar et al., 2012	Self-administered questionnaires	6-knowledge, 3-attitude	Not specified	Frequency (%). Inferential analysis
Nawawi & Rahman, 2015	Self-administered questionnaires	Not specified	Literature review	Frequency (%). Knowledge, low: <14; moderate: 15-18; good >19. Attitude, , low: <3.08; moderate: 3.09-3.51; good >3.52. Practice, low: <3.06; moderate: 3.06-4.03; good >4.04. Inferential analysis.
Sanusi et al., 2017	Self-administered questionnaires	Not specified	Adapted from Mushtaq et al. (29); Desalu et al., (30)	Frequency (%)
Haque et al., 2018	Self-administered questionnaires	9-knowledge, 9-attitude	Literature from WHO (31) and adapted from Mathema et al. (32)	Frequency (%). Inferential analysis. Knowledge, good: 5 and above; poor: 1-4 marks. Attitude, good: 7 and above; poor: 1-6 marks.

CONTINUE

Table III: Description of surveys characteristics of included studies (CONT.)

References	Type of survey	Number of questions	Instrument of validation	KAP analysis
Mohd Salleh et al., 2018	Self-administered questionnaires	66-knowledge,11- attitude, 4-practices	Literature review	Frequency (%). Inferential analysis
Jamaludin et al,, 2019	Self-administered questionnaires	11-knowledge item	Adopted from Fuady et al. (33); Elmi et al. (34); WHO (35)	Frequency (%). Inferential analysis. Knowledge, good: 7-11; poor: 0-6 marks.
Selvaganapathi et al., 2019	Self-administered questionnaires	9-knowledge, 5-practice	Adapted from Adane et al. (36)	Frequency (%). Knowledge, good: 7 and above; moderate: 4 - 6; poor: less than 4 marks. Practices, good: 20 marks and above: poor: less than 20 marks.
Idris, et al., 2020	Self-administered questionnaires	25-knowledge, 5-attitude, 6-practices	Validated unpublished data (from a survey in 2015)	Frequency (%).
Mokhtar & Rahman, 2020	Self-administered questionnaires	19-knowledge	Adapted from ul Haq et al. (37)	Frequency (%). Inferential analysis. Knowledge, good: 6 and above; poor:1-5 marks.
Mokhtar et al., 2020	Self-administered questionnaires	Attitude (5 questions with 26 statements), Self-Preventive Healthcare (1 question with 19 statements)	Literature review	Frequency (%). Inferential analysis. Five positive answers in each category was positive attitude towards TB, less than five positive answers indicated a negative attitude towards TB.
Ramlan et al., 2020	Self-administered questionnaires	25-knowledge, 11-attitude	Adapted from Buregyeya et al. (38); Demissie Gizaw et al. (39); Tenna et al. (40); MOH (41)	Frequency (%). Inferential analysis. The score of median and above: good knowledge and practice, score below the median: poor TBIC knowledge and practice.
Shahbuddin et al., 2020	Self-administered questionnaires	1-knowledge, 4-attitude, 2-practice	Adopted from WHO (42)	Frequency (%). Inferential analysis.
Zaki et al., 2020	Self-administered questionnaires	40-knowledge	Adopted from the MOH (41)	Frequency (%). Inferential analysis. Good knowledge: answered correctly for all 5 sub-questions. Poor knowledge: answered wrongly for at least one question. 24 sub-questions were selected as "must know" questions.
Geok et al., 2021	Self-administered questionnaires	41-knowledge	Adapted from Mohd Salleh et al. (22)	Frequency (%). Inferential analysis. Good knowledge: Higher than mean overall score of the participant (28.45±5.18)

Table IV: Knowledge, Attitude and Practice (KAP) finding of included studies based on the studied populations

References	Findings
General Public	
Koay, 2004	Mean score on knowledge of symptoms was 1.66 (±1.04), range 0-4. Mean score for general tuberculosis knowledge (cause, transmission, prevention, and diagnosis) was 2.13 (±1.17), range 1 -5. 90% knew that TB can be treated by western medicine. 86% said that it can be completely cured if the treatment was completed. Only 33% knew the correct duration for the treatment of TB, 46.2% thought it was 3 months or less and 11.2% did not know the duration. Higher TB knowledge in younger age groups, female and higher education. 51% fell TB patients should not socially mix, 56% would be worried and 41.1% feel embarrassed if they were diagnosed for TB. Younger age groups believed that TB sufferers were dirty. No education and non-Rungus ethnicity would feel more embarrassed if there were diagnosed with TB.
Nawawi & Rahman, 2015	Mean (± SD) of knowledge, attitude and practice score in this study was 16.41 (±1.97), 3.31 (±0.31) and 3.32 (±0.58), respectively. Based on the mean range, the KAP score in this study were classified as moderate. 70.3%, 96.4 and 96% knew the causes, symptoms, and transmission of TB. Higher knowledge among students. Higher attitude in age group 30-39 and the private worker. Higher practices in the 30-39 age group, upper secondary level, unemployed, and private workers.
Mohd Salleh et al., 2018	The mean total scores of knowledge, attitude and practice towards TB among the respondents were 85.54 ± 16.911 (60-132), 51.80 ± 10.83 (20-76) and 7.37 ± 1.956 (4-12). 88.2%, 38.2%, 18.6% and 20.6% of the respondents answered correctly bacteria as the cause of TB, while genetic inheritance, contaminated food and contaminated drink are not the cause, respectively. 91.2%, 73.5%, 50.0%, 27.5% and19.6% of the respondents answered correctly that coughing, sneezing, spitting, talking and laughing can spread the TB infection, respectively. Only 37.3%, 44.1%, 37.3% (38), 38.2%, 39.2% and 22.5% of the respondents knew that genetic, sexual intercourse, sharing clothes, using the same toilet, using the same tooth brush and shaking hands do not spread TB infection, respectively 31% strongly disagree they will feel embarrassed if they have TB, 10% strongly disagree that they would not mingle with TB patients. 15% of respondents believe that TB infection can infect certain people only, while 54% of the respondents agreed that they will go to the health centers if they have TB. For practices, 67% will always quickly go to the hospital if they have TB-related symptoms. No significant difference between genders, age groups, education and income levels with the level of KAP.

CONTINUE

Table IV: Knowledge, Attitude and Practice (KAP) finding of included studies based on the studied populations (CONT.)

References	Findings
General Public	
Geok et al., 2021	56% of participant had good knowledge. Only 13.9% correctly answered all questions concerning transmission, 10.8% on symptoms, 5.1% regarding the investigation, and 1.4% on risk factors. Non-degree education got a higher knowledge score than degree education.
Registered TB patients	
Liam et al., 1999	Patients' mean knowledge score on TB was 3.24 (±1.79), with a range of 0 to 6. Patients with tertiary education, younger age, and students and white collar workers knew more about TB.
Mokhtar & Rahman, 2020	88.2% of TB patients have a high level of TB knowledge. Many respondents answered correctly the way TB spread: cough (95.3%), sneezing (76.9%), talking (54.6%), and spitting (52.6%). Fair knowledge on the way TB spread and its causes: germ or bacteria(81.9%), virus (56.5%), ancestry (28.5%), and contaminated food/drink/water (23.2%). Majority answered correctly TB symptoms, cough up sputum (88.5%), bad cough that lasts 3 weeks or longer (93.5%), fever that lasts 3 weeks or longer (81.6%), and cough up blood (87.5%). 64.1% knew the duration for TB treatment is 6 months. Significant differences in knowledge across states with Penang showed the highest level of TB knowledge, followed by Sarawak, Selangor, Kelantan, Sabah, and Kuala Lumpur, resided in suburban, and self-employed.
Mokhtar et al., 2020	Most of the TB patients believed that if they had a persistent cough for more than three weeks (93.2%), coughed up blood and mucus (86.8%), had a fever for more than three weeks (80.7%), experienced chest pain (75%), or had no appetite (76.2%), they should seek treatment immediately. Most TB patients did not mind eating (78.2%), drinking (77.7%), communicating (80%), and living comfortably in the same house as their family members (77.3%). Slightly lower percentages were documented when it came to friends (67.2%) and neighbours (61.8%). Only 58.5% TB patients practiced wearing nose and mouth covers in public places and washing their hands after coughing or sneezing (59.9%). Furthermore, only 55.6% covered their nose and mouth when coughing or sneezing. Positive TB attitudes were associated with urban patients, who were self-employed and had high school qualifications.
Healthcare worker	
Ramlan et al., 2020	70.6% of HCW had good TBIC knowledge. 98.7% know that TB can be spread through coughing and that they need to educate cough etiquette to the patients. 65.3% answered incorrectly that the surgical mask can prevent them from getting TB. 35.9%, 37.8%, 44.4% and 37.2% incorrectly regarding the mode of transmission, duration of exposure to TB patient, the use of shirt sleeve in cough etiquette and question on sputum induction. Education, family history of TB disease, and working in an outpatient clinic were significant predictors of good knowledge. 51.6% of HCW had good TBIC practice 72.5% of HCW had always worn surgical masks rather than N95 masks when dealing with TB or suspected TB patients, 17.8% never use N95 when dealing with TB patients, 23.8% respondents never do the fit test for N95 and 16.9% never practice separation of TB patient at the designated area away from other patients in the clinic. Having a diploma, being married or widowed, and working in a TBIC clinic were good TBIC practise indicators.
Shahbuddin et al., 2020	100% know where to seek treatment for TB, 98% have heard about TB, 94% know TB is curable and 78% know TB is an airborne disease. 65% know the symptoms and signs of TB and only 20% know which population is at risk of getting TB. 98% of HCW think that TB is dangerous and 97% think TB is endemic in Malaysia and felt vulnerable to TB. 88% of HCW will seek appropriate treatment when they develop TB symptoms. and 5.3% will not tell anyone if they have TB. Doctor group shows significant correlation for health seeking practice.
Zaki et al., 2020	According to the CPG, 28% of clinic doctors, 39% of specialists and 26.2% of MOs had good level of knowledge (showed all correct response for all sub-questions). 74.9% of doctors, 80.2% specialists and 74.6% Mos displaying good TB knowledge with 24 'must know' knowledge questions. Specialists, doctors who have had TB CPG training had a more significant percentage of correct answers. Except for extra-pulmonary TB, doctors in clinics knew more than hospital doctors.
Prison worker	
Haque et al., 2018	80.0% of prison employees had good knowledge on TB. 66% did not know the cause of TB, while 97% (n=97) of them answered it correctly regarding the transmission of TB bacilli. 91% of the respondents did not manage to recognize the symptoms of TB. 64% believed TB is caused by the virus, 34% of the respondents answered the bacterial infection, 1% answered the fungal infection, and 1% did not know about the cause of TB. Longer terms of service were linked to a greater knowledge of TB. 74.0% of prison employees had good attitudes on TB. 94% would go for TB treatment if they were contracted, 85% were worried about getting TB from the other people, 44% disagreed that TB was a shameful disease, 45% agreed that TB is as serious as HIV, 88% stated that TB screening is as important as HIV, 99% would go to the hospital for proper care if they had TB symptoms, and 94% stated that a doctor is the best person for the consultation of TB. A high educational level has a statistically significant relationship.
Selvaganapathi et al., 2019	Knowledge of TB transmission was moderate and good in 66.3% and 26% of prison workers, respectively. 79.5% were not able to identify all the symptoms of TB. 60%, 86.3%, 96.8% and 85.3% give correct answer to questions in regards to mode of transmission, high risk to be contact with TB, TB curability and treatment options for TB, respectively. The majority applied good TB prevention practices (93.7%). 60.5% covering mouth when coughing or sneezing. 80% had strong awareness on the importance of hand washing methods.

CONTINUE

Table IV: Knowledge, Attitude and Practice (KAP) finding of included studies based on the studied populations (CONT.)

References	Findings
Public university students	
Mokhtar et al., 2012	90.5%of respondents have heard of TB, while 80.3% know what TB is. 40%, 66.7% and 78% incorrectly stated TB can spread through contaminated food or drink, genetic and sexual contact, respectively. 40.5% of the respondents feel uncomfortable when they sat near TB patients. 34% felt afraid ofTB patients. 29% stated that they always avoid any physical contacts with TB patients.
Sanusi et al., 2017	78.1% of the respondents were aware of haemoptysis as a clinical symptom of TB, followed by chest pain (78.1%), coughing for over 2 weeks (77.8%), difficult breathing (67.4%), weight loss (55.6%) and loss of appetite (41.5%). 71.1% recognized HIV/AIDS as one of the risk factors of TB, this is followed by living with individual having chronic cough (70.7%), people exposed to TB in their working places (69.3%), smoking cigarette (69.3%) and low income groups (57.4%). Only 37.8% knew diabetes mellitus is second to HIV/AIDS as the risk factor of TB. 82.2% of respondents were aware that TB is curable. 67.8% knows that there are drugs for treating TB. Only 11.1% aware that the actual duration of treatment of TB is within 6 to 9 months.
Jamaludin et al., 2019	Majority (73.8%) possessed a low level of knowledge and awareness of TB. 13% of participants wrongly selected coughing up blood as an early symptom of TB infection and 0.7% of them do not the symptoms of TB disease. 7.4% did not know the exact cause of getting TB disease. 44.8% of respondents wrongly choose washing hands after touching items in public places as a way of preventing TB disease. Medicine Kulliyyah students had highest high knowledge and awareness on TB.
Secondary school students	
Idris et al., 2020	Moderate KAP level, with a total mean knowledge score of 13.5± 4.48 (0-28), attitudes score of 16.4 ± 1.74 (5-25) and practises score of 8.4±1.43 (0-12).

General public

East Malaysians have the least knowledge and attitudes towards TB (18). The northern population has intermediate knowledge but a poor average knowledge score (22). On the other hand, the general population in central Malaysia had a moderate degree of knowledge but a higher average score (12). Studies conducted in the central area reported that the general population's attitude toward TB is poor to moderate (20, 22). Moderate TB practices were reported among general populations living in the central region (20, 22). Majorities would seek treatment if they had a persistent cough or other TB-related symptoms (66.7%). However, half of the respondents never wear masks in public or crowded places and never received a TB medical check-up at least once a year (22).

Registered TB patients

A 1996 study discovered that TB patients had little knowledge of TB. Only 39.3% knew that respiratory droplets spread TB. In comparison, 11.1% believed it was spread by sharing utensils, 44.4% would not dine together with family members with TB, and 49.6% did not know the transmission mode. Meanwhile, 18.5% said they could stop taking the medication once their symptoms went away (17). In contrast, a 2015 survey found a high understanding of TB, with only 11.8% having a low knowledge category. Most patients (89.8%) agreed that TB could be cured, and 79.5% agreed that TB could be avoided (27).

Only one study was done on TB patients' attitudes and practises (27). They had positive attitudes toward TB, health-seeking, and their family members. However, lower attitudes were observed when it came to friends and neighbours. The practices among TB patients were also moderate, with slightly more than half (55.6%) covering their nose and mouth when coughing or sneezing, 58.5% using nose and mouth covers in public locations, and 59.9% washing their hands after coughing or sneezing.

Healthcare worker (HCW)

Findings indicated that many Healthcare Workers (HCWs) had high knowledge levels (8, 27). Nonetheless, only 34.7% correctly answered that the surgical mask could protect them from contracting TB, and only 20.0% identified which population was at risk of contracting TB. According to Zaki et al. (28), only 28% of medical officers and specialists in public hospitals and health clinics in Selangor have a satisfactory level of knowledge of the Clinical Practice Guidelines (CPG) on the management of TB (3rd edition) knowledge.

HCW reported good health-seeking practice, with most of them seeking appropriate treatment upon developing TB symptoms (88%) and will notify if they have TB (95%). Meanwhile, 72.5% of HCWs had always worn surgical masks rather than N95 masks, and 41.3% when dealing with TB or suspected TB patients. Only 23.8% of HCWs never do the N95 fit test, and 16.9% never separate TB patients from other patients in the clinic (27).

Prison worker

Most of the employees stated they knew how to prevent the spreading of TB among prison inmates (63%). Despite this, approximately a third of respondents did not know the cause of TB (66%) and believed TB is caused by a virus (64%) (10). Additionally, only 20.5% of the respondents correctly identified all the symptoms of TB (24).

Employees perceived risks of contracting TB (54%), expressed concern about contracting TB from others (85%), and agreed that TB is as harmful as HIV (45%). Almost all employees would seek treatment for TB if they

contracted it (85%). The lengthy TB treatment schedule, laziness, shyness, not knowing whom to approach, and fear of medications were all cited as reasons for not seeking TB treatment. Moreover, over half of employees believed that TB was a shameful disease (56%) (10).

Most of the employees (97.9%) agree that coughing and sneezing should be covered, that hand washing methods are essential (97.4%), that patients should be isolated if they have TB (93.7%), that adequate ventilation should be provided (96.8%), and that regular sputum examination should be supported (95.8%) (24). Despite this, according to a study conducted by Haque et al. (2018), just a quarter of prison workers have received training in TB prevention and control in jail (25%) (10).

Public University and Secondary School Students

Even though many public university students are aware of TB, there is still a high level of inaccurate understanding of the disease, particularly regarding the causes of the disease, the mechanism of transmission, and the risk factors (19, 21, 23). Regarding TB treatment, even though the students were aware that the disease is curable, only 67.8% and 78.7% were aware that it is curable through specific drugs administered by healthcare professionals, respectively (21, 23). At the same time, 11.1% will still choose herbal remedies to cure (23). A study on students' KAP concerning TB was carried out among secondary students in East Peninsular Malaysia. At the start of the education intervention programme, the reported level of KAP was moderate. According to the study findings, knowledge increased significantly in the intervention group but not in the attitude and practice domain (23).

DISCUSSION

Only 16 records were considered in our review after thoroughly screening 802 relevant records from multiple databases and grey literature sources. There were five different populations studied in the articles included in this review. Despite a small number of KAP surveys being done, our reviews captured the KAP level in studies among general populations and also studies targeting risk groups, such as HCWs, TB patients, and prison employees (3, 4, 43).

General public

Malaysia's National TB Control Program was established in 1961 and included public health education efforts to increase awareness of TB (44). Four studies in general populations demonstrated an increase with time in TB knowledge and a higher score of TB knowledge in urban regions. There is demographic heterogeneity in TB KAP prevention. Note that Sabah accounted for only 10% of Malaysia's population, but 20% of the country's TB notifications between 2012 and 2018 were from this state (45). With reported poor TB-related knowledge and attitude in a study conducted back in 1996, more studies need to be undertaken among Sabahan to determine their current KAP towards TB (18).

Age, education, and gender can affect individuals' understandings, attitudes, as well as practices regarding TB. According to a systematic review by Mohidem et al. (3), few studies show a significant relationship between the age group, low education, and male genders with increased TB risks. However, our reviews show that the elderly, those with lower education, and male genders had poorer KAP towards TB. Thus, combining the current review's findings of high TB risks and low KAP on TB underlines the critical need for a community-wide awareness-raising effort, particularly in this vulnerable group.

Registered TB patients

Studies among TB patients reported that the level of knowledge is increasing over time. Furthermore, patients with TB who are well-informed about their disease are more likely to adhere to therapy. It can also help them identify TB-infected contacts in their network (46). Only one study has been done on their attitude, with family being more positive than neighbours and friends, indicating they are still concerned about TB among their contacts. Their practices are also moderate (11). A positive outlook is required in TB patients. A positive attitude towards their disease can help them overcome negative attitudes such as self-stigmatisation and isolation (47). Thus, immediate intervention is necessary to increase KAP levels, improve treatment adherence, and reduce disease transmission risk.

Healthcare worker (HCW)

An HCW provides care and services, either directly as a doctor or nurse or indirectly as an assistant, helper, laboratory technician, or even a medical waste handler. Factors that increase the likelihood of transmission of TB to HCW include when patients have undiagnosed TB or are receiving incorrect treatment, the healthcare environment, occupational category, individual susceptibility/immune status, and the adequacy of TB infection control measures (48). A systematic review by van der Werf et al. (48) concludes a lack of knowledge on TB among HCWs. Similarly, our study also demonstrates a moderate level of knowledge among the doctors and other HCW categories. Thus, practical training modules on TBIC to provide knowledge and practice on TBIC are essential to all HCW categories.

Prison worker

In densely populated areas, such as prisons, TB is more prevalent.3 The level of KAP among prisoner employees should be known so that effective educational interventions for these high-risk groups can be designed and implemented. Studies on this group in other countries reported low KAP on TB (49). However, studies in Malaysia reported majorities of the prisoner employees had good KAP levels of TB (10, 24). Having

served for a longer period was associated with having more excellent knowledge of TB. Hence, it emphasises the need for continuous health education in all prison employees, from knowledge to appropriate practises in TB, with particular attention given to less-educated employees.

Public University and Secondary School Students

The spread of TB in schools is complex since it threatens global public health. The outbreak highlights that effective TB prevention and control in such settings is essential (50). Three studies on knowledge but none on attitudes and practices have been conducted among public university students. Note that most students were aware of TB. Nonetheless, they had limited knowledge of its causes, transmission, symptoms, and treatment. Identifying their attitudes and practices is critical for infection prevention and treatment-seeking. This highlights the knowledge gap. Meanwhile, only one study examined moderate KAP levels of TB among secondary schools. The study by Idris et al. discovered that school-based TB engagement programmes improved students' knowledge (25).

The WHO 'End TB Strategy' aims to reduce TB deaths by 95% and to lower the incidence of new TB cases by 90% between 2015 and 2035 (WHO, 2015). To support the WHO strategy, Malaysia is also working towards achieving The End TB Strategy goal of ending the global TB epidemic by 2035 (MOH, 2016). Thus, to reduce the burden of TB in Malaysia, according to the WHO End TB Strategy by 2035, one of the proactive and intensified activities, including understanding the KAP of populations and groups at risk, needs to be implemented. All the evaluated studies are advocated for implementing efficient TB prevention and control programmes to reduce the spread of TB infection. Education regarding KAP needs to be provided to communities and high-risk groups. Meanwhile, more studies and research need to be put in place to explore KAP towards TB in other high-risk populations, including immigrants, prisoners, sex workers, and states with high TB cases. Furthermore, employing a qualitative study design of high-risk populations may provide better knowledge and perspective to support intervention implementation in complex situations.

Strength and limitations

The key strength of this study was its use of a systematic search method in various databases and grey literature to cover as many publications as possible. However, certain limitations, such as discrepancies in the variability of questionnaires, scoring method, sample size, and arbitrary cut-offs employed, prevented accurate and decisive comparisons (meta-analysis).

CONCLUSION

The present reviews summarise that Malaysian populations have a wide range of KAP toward TB. Even among those at high risk for TB, a lack of critical TB-related knowledge, negative attitudes toward the disease, and poor preventive and health-seeking practices are still prevalent. Other than that, the KAP about TB also varied according to demographic characteristics, with the low levels of TB-related KAP associated with the more socially disadvantaged group. Together with the Ministry of Health, other relevant bodies and stakeholders should consider providing regular health education programs and advertising to improve TB KAP at all community levels and high-risk groups.

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