

Journal Information

Publisher: Pharmascope Publication
Title: International Journal of Research in
Pharmaceutical Sciences
ISSN (print):

Article Information

Copyright: 2019
Volume: 10
Issue: 4
Page: 2632
DOI: <https://doi.org/10.26452/ijrps.v10i4.1521>

A cross sectional study on knowledge, attitude and practice towards tuberculosis among health care workers

Ajith Kumar G[1]

Saranya P[1]

Email: saro08bpharm@gmail.com

Department of Pharmacy Practice, School of Pharmaceutical Sciences, Vels Institute of Science, Technology and Advanced Studies Chennai, Tamil Nadu, 600 117, 9962387908 India

Corresponding Author: Saranya P

Abstract

Health care providers play a major role in the management of tuberculosis (TB). The knowledge, attitude and practice towards TB in health care providers will have an impact on the treatment success or failure. Studies have reported that inadequate knowledge of the health care providers led to the delivery of improper counselling content to the recipients. We assessed the knowledge, attitude and practice (KAP) towards tuberculosis among health care workers in and around Chennai. A cross sectional study was conducted among 382 health care workers of the chest and tuberculosis department of government hospitals and directly observed treatment short-course clinics. The principal investigator administered a structured and validated questionnaire to the study participants. Around 500 healthcare workers were approached, and 382 showed interest to sign the informed consent. A majority (70%) of the study participants were between the age group 20-30 years. There was a highly significant difference response to the statement that patient medication non-adherence to ATT was due to its

adverse effects, between participants who had a history of active tuberculosis and undergone treatment for the same, and the participants with no history of TB. There was a significant difference between the study population based on their qualification and profession ($P = 0.001$ and $P = 0.007$ respectively) in using the Revised National Tuberculosis Control Program guideline for reference. The knowledge attitude and practice towards TB was good in more than 80% of the respondents, yet there is room to improve. Structured periodic training towards TB will further improve the KAP of health care workers.

Keywords

clinical pharmacist perspective, drug-resistant tuberculosis, health care workers, KAP, prospective study, RNTCP, tuberculosis

Introduction

Tuberculosis is one of the leading causes of morbidity and mortality worldwide. It is caused by *Mycobacterium tuberculosis*, a small aerobic, non-motile bacillus. *Mycobacterium tuberculosis* complex includes four other TB-causing mycobacteria which are *M. bovis*, *M. africanum*, *M. canetti* and *M. microti*. *Myocobacteirum bovis* was once a common cause of tuberculosis (Smith, 2003). According to the World Health Organization (WHO), approximately there were more than 10 million cases of active TB, which resulted in 1.6 million deaths in 2017. India is the highest TB burden country with WHO statistics in 2016 giving an estimated incidence of 2.79 million cases of TB for India out of a global incidence of 10 million cases (APA, 2017). TB is an airborne pathogen that spreads by inhalation. The most common symptoms for active tuberculosis are feeling sick or weak, loss of appetite and weight loss, chills, fever, and night sweats, a severe cough that lasts for 3 weeks or more, chest pain and bloodstained sputum (Saranya, Part hasarathy, Hariprasad, & Rani, 2016). About 90% of those infected with *M. tuberculosis* are asymptomatic, called latent TB infections (Mahendra, Tirtodiharjo, & Kusuma, 2016).

Tuberculosis may infect any part of the body like kidney, lymph nodes, bones, joints but most commonly occurs in the lungs, which is known as pulmonary tuberculosis (Agrawal, Patgaonkar, & Nagariya, 2010). The most

common medications used to treat tuberculosis include Isoniazid, Rifampin, Ethambutol, Pyrazinamide. Other antibiotics are active against TB and are primarily used when patients have drug-resistant TB (Pinto & Menzies, 2011). The common most important classes are aminoglycosides and fluoroquinolones. Anti-TB medicines have been used for decades and strains that are resistant to 1 or more primary anti-tuberculosis drugs arises when the anti-TB medicines are used inappropriately. Through incorrect prescription by healthcare providers, treatment prematurely stopped by patients; inadequate patient counselling are associated with the emergence of drug-resistant strains of *M. tuberculosis* (Lowther & Bryskier, 2002).

Health care providers play a major role in the management of TB. The knowledge, attitude and practice towards TB in health care providers will have an impact on the treatment success or failure. Studies have reported that inadequate knowledge of the health care providers led to the delivery of improper counselling content to the recipients (Sima, Belachew, & Abebe, 2019). Tuberculosis infection control is a major concern in India. Researches reveal that practice towards tuberculosis and its infection control is poor even in health facilities, and health care workers are at higher risk of acquiring active/latent tuberculosis infection (Joshi, Reingold, Menzies, & Pai, 2006). Adequate knowledge, attitude and practice towards tuberculosis have to be delivered by the health care workers to achieve a good infection control and successful treatment outcome in patients with tuberculosis. Though they are at a higher risk to acquire TB, they play a significant role in tuberculosis infection control and prevention of the emergence of drug-resistant strains (Kigozi, Heunis, Engelbrecht, Rensburg, & Rensburg, 2017). Hence, we assessed the knowledge, attitude and practice towards tuberculosis among health care workers in and around Chennai.

Materials and Methods

A cross sectional study was conducted among 382 health care workers of the chest and tuberculosis department of government hospitals and DOTS clinics. This study was approved by the Institutional ethics committee, Vels Institute of Science, Technology and Advanced studies. All the healthcare professionals working in the selected health facility with the qualification for the doctor, health officers, nurse, X-ray technician, pharmacist and laboratory personnel were enrolled into the study after obtaining written

informed consent. A structured knowledge, attitude and practice questionnaire was developed and validated statistically (Reliability 0.710) with the results of a pilot study.

Procedure

The study was initiated after obtaining approval from the institutional ethics committee. All government hospitals and DOTS clinic in Chennai were identified, and any five hospitals and five DOTS clinic was selected by simple random sampling technique. Health professionals of the selected speciality were enrolled in to study if they were willing to give written informed consent. Health workers were identified by their profession and selected by simple random sampling technique. Structured questionnaire to assess the knowledge, attitude and practice of health care professionals towards tuberculosis was developed and validated statistically. The principal investigator administered the questionnaire to study participants and completed data collection. An information leaflet self-explaining about the disease tuberculosis and its infection control was given to all study participants to improve their knowledge towards tuberculosis and its infection control. The collected data was entered in Microsoft Excel spreadsheet and utilized further for statistical analysis. The data was analyzed by SPSS software for logistic regression analysis.

Results and Discussion

Ethics approval and patient enrollment

Tuberculosis, an infective disease caused by mycobacterium tuberculosis, is highly prevalent in India. We assessed the knowledge, attitude and practice towards tuberculosis among the health care workers. The study protocol was approved by the institutional committee with reference no: VISTAS-SPS/IEC/IX/2018/06. Around 500 healthcare workers were approached, and 382 showed interest to sign the informed consent. The health care workers were enrolled into the study based on the inclusion and exclusion criteria.

Table 1 Age distribution

Age Distribution	Percentage(%)
20-30	70%
31-40	25%
41-50	5%

Age Distribution	Percentage(%)
51-60	2%

Table 2 Distribution based on profession experience

Profession Experience	Percentage(%)
<1 YEAR	4%
1-5 YEAR	58%
6-10 YEAR	24%
11-15 YEAR	10%
16-20 YEAR	2%
>20 YEAR	5%

Figure 1 Gender distribution


 https://typeset-prod-media-server.s3.amazonaws.com/article_uploads/ce4e1c00-08c7-454d-a75d-046f61b892b6/image/05a5b80d-8199-4575-9f8f-af25a526347c-upicture1.png

Figure 2 Distribution of marital status

 https://typeset-prod-media-server.s3.amazonaws.com/article_uploads/ce4e1c00-08c7-454d-a75d-046f61b892b6/image/548cd016-374b-4f29-bd31-04289ebe057f-upicture2.png

Figure 3 Distribution based on profession


 https://typeset-prod-media-server.s3.amazonaws.com/article_uploads/ce4e1c00-08c7-454d-a75d-046f61b892b6/image/11b65cd4-e081-4a32-ad0c-edc2a6f8422a-upicture3.png

Figure 4 Distribution based on education


 https://typeset-prod-media-server.s3.amazonaws.com/article_uploads/ce4e1c00-08c7-454d-a75d-046f61b892b6/image/1297287b-74e6-4092-b335-c27df162de14-upicture4.png

Figure 5 Distribution based on the history of TB

 https://typeset-prod-media-server.s3.amazonaws.com/article_uploads/ce4e1c00-08c7-454d-a75d-046f61b892b6/image/d5bb24b1-8e4e-4394-a967-76732ff1d17e-upicture5.png

Table 3 Distribution based on responses to knowledge questions

S.No	Questions	Response					Gender	P Value		
		Strongly agree N(%)	Agree N(%)	Not sure N(%)	Disagree N(%)	Strongly disagree N(%)		Qualifi cation	profes sion	Diagnosed for TB
1	TB suspected should be separated from the rest of the patient	191(55)	181 (47)	8 (2)	2 (1)	0	0.057	0.541	0.498	0.553
2	Surgical mask cannot protect the	168 (44)	169 (44)	15 (4)	23 (6)	7 (2)	0.859	0.478	0.522	0.853

S.No	Questions	Response					Gender	P Value		
		Strongly agree N(%)	Agree N(%)	Not sure N(%)	Disagree N(%)	Strongly disagree N(%)		Qualification	Profession	Diagnosed for TB
	health worker from TB									
3	Respirator can protect the HW from TB	146 (38)	156 (41)	63 (16)	17 (5)	0	0.368	0.593	0.939	0.653
4	TB patients have to be educated to cover their mouth with a handkerchief	224 (59)	140 (37)	18 (4)	0	0	0.390	0.026	0.792	0.221
5	Regular screening of health worker for TB is one of TBIC measures	177 (46)	193 (51)	12 (3)	0	0	0.684	0.796	0.964	0.277
6	TB cannot be transmitted from person to person by blood contact	152 (40)	176 (46)	35 (9)	5 (1)	14 (4)	0.746	0.775	0.938	0.060
7	Sputum microscopy is the most effective tool for the diagnosis of TB	225 (59)	120 (32)	24 (6)	0	10 (3)	0.474	0.768	0.953	0.541
8	Mycobacterium bacillus resistant to at least isoniazid and rifampicin is multidrug-resistant tuberculosis?	183 (48)	147 (39)	48 (12)	4 (1)	0	0.619	0.346	0.737	0.652
9	MDR-TB is contagious	159 (42)	168 (44)	51 (13)	0	4 (1)	0.685	0.379	0.737	0.728
10	MDR-TB is diagnosed from a drug susceptibility test (DST)	167 (44)	175 (46)	36 (10)	0	0	0.464	0.152	0.180	0.614

Table 4 Distribution based on responses to attitude questions

S.No	Questions	Response					Gender	P Value			
		Strongly agree N (%)	Agree N (%)	Not sure N (%)	Disagree N (%)	Strongly disagree N (%)		Qualification	profession	Diagnosed for TB	
1	Do you think sputum microscopy for AFB has to be ordered for a patient suspected with TB	181 (47)	161 (43)	37 (9)	3 (1)	0	0.606	0.141	0.539	0.380	
2	At the end of the intensive phase, should the sputum examination for CAT-1 patients has to be repeated?	123 (33)	177 (46)	82 (21)	0	0	0.262	0.260	0.183	0.683	
3	Do you educate the TB patients about prevention of TB transmission	211 (55)	144 (38)	26 (6)	1 (1)	0	0.039	0.313	0.135	0.133	
4	Do you think the family members of TB patient has to be screened for TB infection	168 (44)	162 (43)	46 (12)	6 (1)	0	0.999	0.524	0.602	0.113	
5	Do you think that counselling the patient towards TB and its treatment, improve patient medication adherence?	200 (53)	148 (39)	21 (6)	4 (1)	3 (1)	0.499	0.447	0.644	0.547	
6	Do you think MDR-TB arises due to medication non-adherence	154 (40)	168 (44)	51 (13)	6 (2)	3 (1)	0.646	0.666	0.857	0.708	
7	Do you think health care workers required periodic education towards TB and its infection control	187 (49)	167 (44)	20 (5)	3 (1)	5 (1)	0.526	0.013	0.215	0.148	
8		154 (40)			3 (1)	0	0.334	0.183	0.146	0.006	

S.No	Questions	Response					Gender	P Value		
		Strongly agree N (%)	Agree N (%)	Not sure N (%)	Disagree N (%)	Strongly disagree N (%)		Qualification	profession	Diagnosed for TB
	Do you think patient medication non-adherence is due to adverse effects of ATT(Anti TB therapy)		159 (42)	66 (17)						
9	Do you think health care workers require screening for latent/active TB infection periodically	144 (37)	203 (53)	30 (8)	3 (1)	2 (1)	0.351	0.919	0.758	0.157
10	Do you think the staff who have evidence of LTB should receive prevention treatment	131 (34)	176 (46)	0	11 (3)	0	0.609	0.205	0.231	0.141

Table 5 Distribution based on practice questions

S.No	Questions	Response					Gender	P Value		
		Strongly agree N (%)	Agree N (%)	Not sure N (%)	Disagree N (%)	Strongly disagree N (%)		Qualification	profession	Diagnosed for TB
1	Follow TB treatment guideline to treat smear-positive patient.	183 (48)	181 (48)	18 (4)	0	0	0.606	0.718	0.728	0.910
2	Opening window when TB suspected patient is in the room.	163 (42)	41 (153)	17 (4)	40 (11)	9 (2)	0.254	0.813	0.785	0.161
3	Using a mask when approaching TB suspected patient.	213 (56)	158 (42)	11 (2)	0	0	0.341	0.668	0.515	0.175
4	Gives priority to patients	143 (38)	195 (51)	2 (1)	36 (9)	6 (1)	0.776	0.938	0.956	0.794

S.No	Questions	Response					Gender	P Value		
		Strongly agree N(%)	Agree N(%)	Not sure N(%)	Disagree N(%)	Strongly disagree N(%)		Qualification	Profession	Diagnosed for TB
	coughing in the waiting area									
5	Educates TB suspected patients how to cough and sneeze	216 (56)	159 (42)	6 (1)	1 (1)	0	0.087	0.078	0.742	0.717
6	Use AFB as diagnostic tool for TB suspected patients	154 (41)	184 (48)	44 (11)	0	0	0.668	0.499	0.281	0.176
7	Undergoes regular screening for latent TB infection?	154 (41)	131 (50)	31 (8)	2 (1)	4 (1)	0.531	0.143	0.676	0.462
8	Surgical mask was available for TB suspected patients	185 (48)	167 (44)	23 (6)	7 (2)	0	0.667	0.455	0.440	0.751
9	Undergoes periodic training for TB management and TBIC	168 (44)	163 (43)	51 (13)	0	0	0.320	0.122	0.027	0.590
10	Always uses RNTCP guideline for reference	188 (49)	167 (46)	19 (5)	0	0	0.225	0.001	0.007	0.093

All the healthcare professionals working in the selected health speciality with the qualification for the doctor, health officers, nurse, X-ray technician, pharmacist and laboratory person were included in the study. Health care professionals those who could not consent and on annual/ long leave were excluded.

Demographics of the study participants

A majority (70%) of the study participants were between the age group 20-30 years, followed by 31-40 (25%) years. Most of the health care workers participated in this study was female (85%). Around 69% of the participants

were nurses, followed by Pharmacists (27%). BSc Nursing (54%) and Diploma in nursing (16%) were the most common education pursued. A greater part of the study participants had a work experience of 1-5 years (58%) and 6-10 years (24%). The distribution of demographic details like age, gender, marital status are shown in [Table 1](#), [Figure 1](#) and [Figure 2](#) other details like profession, education and experience are presented in [Figure 3](#), [Figure 4](#) and [Table 2](#) respectively. About 45% of participants had a history of tuberculosis ([Figure 5](#)).

Assessment of Attitude

There were 10 questions in the attitude section of the questionnaire. All the participants responded to every question in the questionnaire. Around 47% and 43% of the study participants strongly agreed and agreed respectively, to the question on whether they think sputum microscopy for AFB has to be ordered for a patient suspected with TB, which indicates the positive attitude of the majority of the study participants. Nearly 21% of the study population were not sure whether to repeat sputum examination for CAT-I patients at the end of the intensive phase. Most of the health care workers had a positive attitude in educating the TB patients in preventing TB transmissions (55%, strongly agree and 38%, agree) and to screen family members of TB patients for TB infection (44%, strongly agree and 43%, agree). Around 53% of the health care workers strongly agreed, and 39% agreed that counselling the patient towards TB and its treatment will improve patient medication adherence. The attitude towards the rise in MDR TB was good. Nearly 84% (40% + 44%) of the participants were sure that medication non-adherence may lead to MDR TB. They had a positive attitude when asked whether they need to be educated periodically towards TB and its infection control (49%, strongly agree and 44%, agree) and whether they think medication non-adherence is due to ADR to ATT (40%, strongly agree and 42%, agree). A majority of the participants strongly agreed and agreed to be screened for latent or active TB infection periodically (37%, strongly agree and 53%, agree) and to the statement staff who have evidence of latent TB should receive prevention treatment (34%, strongly agree and 46%, agree), respectively. The overall attitude of the study population was observed to be good. The distribution of responses to the attitude part of the questionnaire is presented in [Table 4](#) and [Figure 7](#).

Figure 6 Distribution based on knowledge responses


 https://typeset-prod-media-server.s3.amazonaws.com/article_uploads/ce4e1c00-08c7-454d-a75d-046f61b892b6/image/4b5ec8f1-b2fa-434b-adb5-f7ec81fc04d9-upicture6.png

Figure 7 Distribution based on attitude responses



 https://typeset-prod-media-server.s3.amazonaws.com/article_uploads/ce4e1c00-08c7-454d-a75d-046f61b892b6/image/7a1592df-b1e5-43e9-bd44-9cab8f0e5825-upicture7.png

Figure 8 Distribution based on practice responses

 https://typeset-prod-media-server.s3.amazonaws.com/article_uploads/ce4e1c00-08c7-454d-a75d-046f61b892b6/image/197bf371-c343-4eb0-a1fd-46f223e51368-upicture8.png

Assessment of Practice

The practice of health care workers towards tuberculosis may vary with their knowledge and attitude towards the disease. The knowledge and attitude of the study population was observed to be good. The practice towards TB was assessed from their responses to the 10 questions in the practice questionnaire. Most of the participants strongly agreed (48%) and agreed (48%) that TB treatment guideline was followed to treat smear-positive patients. A majority of the participants has strongly agreed (42%) and agreed (41%) that they would open the window if a TB suspected patient is in the room, which is a positive attitude. Around 98% of the participants have used a mask when approaching a TB suspected patient. Nearly 9% of the health care workers disagreed to give priority to patients coughing in the waiting area. Almost 98% of the participants educate TB patients how to cough and sneeze. Around 90% of the study population undergoes screening for latent TB infection. Only 2% of the participants disagreed for the availability of surgical mask for TB suspected patients. Most of them have undergone periodic training for TB management and TB infection control (87%) and always use RNTCP guideline for reference (95%). The distribution of responses to practice questionnaire is shown in [Table 5](#) and [Figure 8](#).

As per the annual report of RNTCP (2017), about 10 million cases of active TB is reported globally, and 1/4th of the global incident cases occur in India annually. Knowledge, Attitude and practice of health care workers towards tuberculosis are a highly essential factor effective tuberculosis infection control. In our study, the average age of the study population was 28.82 years, which is similar to the study population of ([Demissiegizaw, Alemu, & Kibret, 2015](#)), and lesser than that of, the majority of the participants were female (85%), which is in line with the study reported, and greater than that reported by ([Pathak, Harrington, & Dobler, 2016](#)) (71%) and (73%) Most of

the participants in our study were nurses by profession (69%), which is similar (66%) to that recorded by (Pathak et al., 2016) and lesser than (98.2%) that reported. About 54% participants had BS.c nursing as their qualification, and 9% had B.Pharm. The overall qualification of the study population was observed to be good as a health care worker for TB patient. This was found to be similar to the study conducted and (Bhandari & Bande, 2016). The majority (58%) of the population had professional experience of at least 1-5 years in our study, which is lesser than that reported by (30%) and greater than (43%) that of (11) All most 97% of the participants knew that the TB suspected should be separated from the rest of the patient, which is slightly more than that reported by (Demissiegizaw et al., 2015) (91.4%). The knowledge on a surgical mask and its protection was good in about (88%) of our population, which is greater than (38.8%) that reported by (Demissiegizaw et al., 2015). The overall knowledge of our study population was good and higher when compared to and (Pathak et al., 2016) and (Bhandari & Bande, 2016). There was no significant difference observed between gender, profession, qualification and history of TB among the study participants.

Almost 88% of the study participants had a good attitude towards educating tuberculosis patients in the prevention of TB transmission. This was found to be greater than the respondents of (Pathak et al., 2016). Most of the respondents (93%) showed good attitude towards receiving periodic education towards TB and its infection control. There was a significant difference ($P=0.013$) between participants based on their qualification when they responded to the same. Eighty-two percentage of the respondents agreed strongly that patient medication non-adherence to ATT was due to its adverse effects. There was a highly significant difference ($P = 0.006$) in response to this between participants who had a history of active tuberculosis and undergone treatment for the same, and the participants with no history of TB. Around 83% of the participants agreed strongly that they open the window if a TB suspected patient is in the room. This is found to be greater than that reported by (Bhandari & Bande, 2016). A majority (98%) of the respondents uses a mask when approaching TB suspected patients. This is similar to the results of (Demissiegizaw et al., 2015; Pathak et al., 2016). (Eighty-seven percentage of the study population undergoes periodic training for TB management and TB infection control. There was a significant difference ($P = 0.027$) between participants based on their profession

distribution. Ninety-five percent of the respondents agreed that they use RNTCP guideline for reference. There was a significant difference between the study population based on their qualification and profession ($P = 0.001$ and $P = 0.007$ respectively) (Easwaran et al., 2015).

Conclusion

We assessed the Knowledge, attitude and practice of health care workers towards tuberculosis using a structured and validated questionnaire. The reliability of the questionnaire was acceptable. We observed that the knowledge, attitude and practice of the respondents were good. The health care workers lack in periodic training towards TB and TB infection control. Educating them periodically will help them to deliver good TB patient care and counsel them well, thereby can help in preventing the transmission of TB. Though the knowledge attitude and practice towards TB was good in more than 80% of the respondents, there is room to improve. Structured periodic training towards TB will improve their KAP.

References

- 1 Smith, I, (2003). Mycobacterium tuberculosis Pathogenesis and Molecular Determinants of Virulence. *Clinical Microbiology Reviews*, 16(3), 463–496. [10.1128/CMR.16.3.463-496.2003](https://doi.org/10.1128/CMR.16.3.463-496.2003)
- 2 APA, , (2017). APA Council Launches Initiatives to Engage International Psychiatrists. *Psychiatric News.*, 52, 1. [10.1176/appi.pn.2017.9a18](https://doi.org/10.1176/appi.pn.2017.9a18)
- 3 Saranya, P, Parthasarathy, V, Hariprasad, B & Shobha Rani, H, (2016). Effect of diabetes mellitus on rifampicin peak serum concentration. *Int J Pharm Pharm Sci*, 8(10), 149–152.
- 4 Mahendra, A D, Tirtodiharjo, M K & Kusuma, I T D, (2016). The Pattern of Bacteria and its Resistance on Adult Sepsis Patient at Dr.Moewardi General Hospital., 44032. Indonesia. bioRxiv
- 5 Agrawal, V, Patgaonkar, P R & Nagariya, S P, (2010). Tuberculosis of spine. *Journal of craniovertebral junction and spine*, 1(2), 74.
- 6 Pinto, L & Menzies, D, (2011). Treatment of drug-resistant tuberculosis. *Infection and drug resistance.*, 4, 129–135.

- 7 Lowther, J & Bryskier, A, (2002). Fluoroquinolones and tuberculosis. *Expert Opinion on Investigational Drugs*, 11(2), 233–258. [10.1517/13543784.11.2.233](https://doi.org/10.1517/13543784.11.2.233)
- 8 Sima, B T, Belachew, T & Abebe, F, (2019). Health care providers' knowledge, attitude and perceived stigma regarding tuberculosis in a pastoralist community in Ethiopia: a cross-sectional study. *BMC Health Services Research*, 19(1). [10.1186/s12913-018-3815-1](https://doi.org/10.1186/s12913-018-3815-1)
- 9 Joshi, R, Reingold, A L, Menzies, D & Pai, M, (2006). Tuberculosis among Health-Care Workers in Low- and Middle-Income Countries: A Systematic Review. *PLoS Medicine*, 3(12), e494. [10.1371/journal.pmed.0030494](https://doi.org/10.1371/journal.pmed.0030494)
- 10 Kigozi, N G, Heunis, J C, Engelbrecht, M C, Rensburg, A P Janse Van & Rensburg, H C J D Van, (2017). Tuberculosis knowledge, attitudes and practices of patients at primary health care facilities in a South African metropolitan: research towards improved health education. *BMC Public Health*, 17(1), 795. [10.1186/s12889-017-4825-3](https://doi.org/10.1186/s12889-017-4825-3)
- 11 Demissiegizaw, G, Alemu, Z Aderaw & Kibret, K T, (2015). Assessment of knowledge and practice of health workers towards tuberculosis infection control and associated factors in public health facilities of Addis Ababa, Ethiopia: A cross-sectional study. *Arch Public Health*, 73(1), 15. [10.1186/s13690-015-0062-3](https://doi.org/10.1186/s13690-015-0062-3)
- 12 Pathak, V, Harrington, Z & Dobler, C C, (2016). Attitudes towards preventive tuberculosis treatment among hospital staff. *Peer J*, 4, e1738. [10.7717/peerj.1738](https://doi.org/10.7717/peerj.1738)
- 13 Bhandari, S.R. & Bande, R, (2016). Knowledge, attitude and practice against tuberculosis infection control among medical students and nursing staff. *J Cont Med A Dent*, 4(2), 29–32.
- 14 Easwaran, M, Ramachandran, D, Ramasamy, R, George, N, Mathew, M, Bazroy, J & Singh, Z, (2015). Knowledge, attitude, and practice regarding tuberculosis among rural population in Tamil Nadu. *International Journal of Medical Science and Public Health*, 4(12), 1681. [10.5455/ijmsph.2015.08052015344](https://doi.org/10.5455/ijmsph.2015.08052015344)