Original Research Article

Knowledge, Attitude and Practices of Healthcare Professionals towards Tuberculosis, Multi Drug Resistant Tuberculosis and Extensively Drug Resistant Tuberculosis: An Online Cross-Sectional Survey

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Abstract

Introduction: Tuberculosis (TB) has been a scourge to the mankind from the time immemorial, and despite availability of anti-tubercular drugs since 1940s, TB has continued to plague mankind. Over the past few decades drug resistance in TB particularly the multi drug resistant (MDR) and extensively drug resistant (XDR) TB has emerged as a major public health concern. In order to treat any disease effectively and efficiently, it is very important to have thorough knowledge, positive attitude and good practices towards the same.

Aim: To evaluate the knowledge attitude and practices of health-care professionals (HCPs) towards tuberculosis, MDR/XDR-TB and to gain insight into currently practiced tuberculosis infection control measures.

Materials and Methods: This cross-sectional, questionnaire-based survey was conducted in May 2021. Data was collected online, via a self-reported questionnaire, using a Google form. A link to the Google form was distributed to respondents via WhatsApp groups and email. A total of 423 HCPs reverted back with the filled form, the data for the same managed on excel spread sheet. Simple descriptive statistics were used to generate frequencies, percentages, and proportions.

Results: Out of the total study participants 51.8% were males whereas 48.2% were females. The participants were asked about the different aspects of TB, MDR/XDR-TB including the causative agent, modes of transmission, common symptoms, diagnosis, management and the course of treatment. The overall knowledge, attitude and practices of the HCPs towards TB was noted to be good, however level of awareness regarding the MDR/XDR-TB, particularly the diagnosis and management was noted to be slightly lesser. Majority of the participants were open for regular training programmes and to get tested for TB regularly. TBIC practices

among the HCPs were also noted to be good, however majority of the participants believed that theere is still a scope for improvement in TB control programmes in their region.

Conclusion: It was observed in our study that HCPs had an overall good knowledge level, attitude and practices towards the TB however there is a need to increase the knowledge and awareness about MDR/XDR-TB, particularly the basic definition, prevalence, transmission dynamics, available diagnostic modalities, duration of treatment and possible outcomes is very important, more so in high burden countries like India, where the risk of exposure to drug resistant strains is quite high.

Keywords: Anti tubercular drugs, Bedaquiline**,** Delamanid, DOTS, Infection control, RNTCP

Introduction

Tuberculosis (TB) the second leading cause of death among the infectious diseases (after human immunodeficiency virus) continues to be a major public health threat worldwide, more so in the developing world. [1] The "captain of all these men of death", TB has been a scourge of the mankind from time immemorial, not only due to its effects as a medical problem but also by its impact as a socio-economic tragedy. [2] Despite availability of drugs since 1940s, TB has continued to plague mankind. The burden of disability and death due to TB is immense and, till date, no other disease in history matches the sheer magnitude of the misery inflicted by TB on the human race in terms of morbidity and mortality. [1]

Presently, the WHO estimates that one-third of the world's population is infected with *Mycobacterium tuberculosis.* In 2017, there were 10 million new cases of TB and it accounted for 1.3 million deaths. [3] Over 95% of TB deaths occur in low and middle-income countries and 75% of cases being the most economically productive age group (15–54 years). The six countries that stand out as having the largest number of incident cases in 2017 were India, China, Indonesia, Philippines, Pakistan, and Nigeria. India accounts for 23% of the global TB incidence with an estimated 2.2 million cases reported in 2014. [3]

Drug resistance in TB is another major public health concern and the global efforts to control the TB pandemic have been considerably undermined by the emergence and dissemination of the strains resistant to anti-tubercular drugs. [4] Strains resistant to atleast isoniazid and rifampicin, the two most potent first line TB drugs, are termed as multidrug resistant (MDR-TB) strains, while extensively drug-resistant (XDR-TB) strains are, the MDR-TB strains additionally resistant to a flouroquinolone, and to atleast one of the three second-line injectable drugs (kanamycin, amikacin and capreomycin). [4] Globally, nearly half a million people are estimated to have MDR-TB annually, and only one-fourth of them get adequate treatment. [5,6] In 2016, there were an estimated 490 000 new cases of MDR-TB and approximately 240 000 deaths from MDR-TB. [3] More than 90% of these cases were from 30 countries that belong to low or middle-income settings. [3]

Problem of MDR-TB is largely attributed to inadequate treatment of TB either by physician/health care provider or due to incomplete treatment/poor drug compliance by patient. Correct knowledge of disease as well as complications, timely and accurate diagnosis of TB/drug resistant TB is of utmost importance as it not only will prevent the disease

progression but will also be helpful in preventing the transmission of MDR and XDR-TB strains. Needless to mention that the treatment of MDR-TB and XDR-TB is difficult, as it requires second-line drugs, some of which are only injectables, are less efficacious, more toxic, and more expensive than the first-line agents. [4,7]

Healthcare workers (HCWs) play an integral role in the global fight against TB. However, they themselves have a high risk of becoming infected with TB, as they are exposed to TB patients on regular basis. [8] A recent meta-analysis found an approximately three-times higher incidence of active TB amongst HCWs as compared to the general population. [9] Although, the occupational TB prevention and infection control (TBIC) measures in any healthcare settings are of paramount importance, but at times it is more challenging to adhere to the same, particularly in low and middle income countries or in resource-constrained settings, as may be the case in majority of the Indian rural primary health centers (PHCs) and community health centers (CHCs). The situation is further aggravated by the MDR/XDR-TB cases.

With the above background the current study was aimed to evaluate the knowledge attitude and practices (KAP) of health-care professionals (HCPs) towards tuberculosis, MDR/XDR-TB and to gain insight into currently practiced TBIC measures.

Materials and Methods

Study design: This study was a cross-sectional, questionnaire-based survey and used qualitative methods to explore the knowledge, attitude and practices of the health care professionals (HCPs) towards TB, MDR-TB and XDR-TB.

Study duration and Sampling procedure: The study was conducted from 24 May 2021 to 30 May 2021. Given the social distancing (physical distancing) measures, restricted movement and lockdowns due to COVID-19 pandemic, data was collected online, via a self-reported questionnaire, using a Google form. A link to the Google form was distributed to respondents via WhatsApp groups and email. As, the larger the target sample size, the higher the external validity and greater the generalizability of the study, hence, this study aimed to maximize reach and gather data from as many respondents as possible.

Study population: A total of 423 HCPs (primary care physicians/medical doctors: 211; nursing staff: 107; paramedical staff: 64; pharmacists: 41) working in both government and private hospitals were included in the study.

Study Questionnaire: Based on the previously published studies [10,11], WHO treatment guidelines for drug resistant TB [7] and Revised National Tuberculosis Control Program (RNTCP) guidelines for management of TB and drug resistant TB in India [12,13], a modified, self-reported questionnaire (Appendix 1) was designed specifically for this study. On the first page of the online questionnaire, respondents were clearly informed about the background and objectives of the study. Respondents were informed that they were free to withdraw at any time, without giving a reason, and that all information and opinions provided would be anonymous and confidential. Respondents who understood the content of the questionnaire, and voluntarily agreed to participate in the study were instructed to complete the questionnaire. Online informed consent was obtained from the participants before proceeding with the questionnaire.

The final questionnaire consisted of two parts: Part 1 and Part 2. Part 1 sought the socio-demographic and professional information of the study participants, whereas Part 2 was divided into three subsections:

- Part 2 (Section A): Noted the level of knowledge about the symptoms, transmission, treatment, diagnosis of TB and, definition and approach towards MDR/XDR-TB and consisted of 19 questions. The questions had a simple yes/no/I don't know response while some of the questions allowed multiple responses.
- Part 2 (Section B): Consisted of nine questions, to assess the level of attitude towards TB, associated stigma and the public health concerns on MDR/XDR-TB. The questions had a simple yes/no/not sure response, with an additional brief note required from participants wherever necessary.
- Part 2 (Section C): Consisted of 10 questions, on the study participants' self-reported practices on attending, triaging, prioritizing the TB patients and the measures infection control measures they follow while encountering the TB patients. A 4-point likert scale, whose responses ranged from "never" to "always" was used to note the responses.

Statistical Analysis: The data obtained was managed on an Excel spreadsheet. Simple descriptive statistics were used to generate frequencies, percentages, and proportions.

Results

Out of the total 423 study participants, 219 (51.8%) were males and 204 (48.2%) were females. The mean age of the participants was 38.4 years. 165 (39.0%) participants had education up to post graduation (MD, MS, M.Sc. medical laboratory technology and M.Sc. Nursing), whereas 139 (32.9%) were under graduates (MBBS, B.Sc. medical laboratory technology, Bachelors in Pharmacy, Post Basic B.Sc. Nursing), 97 (22.9%) were diploma holders (general nursing and midwifery, diploma in medical laboratory technology and diploma in pharmacy) and only 22 (5.2%) participants had a super speciality qualification (DM, M.Ch and Ph.D.). Majority of the participants (298; 70.4%) had an experience of working in a health care setup for >3-5 years, whereas 125 participants (29.6%) were working in health care set up for <3 years. The professional information of the study participants is depicted in Table 1.

Table 1: Professional information of the study participants. (*n*=423)

Question	Yes	No	Not sure
Have you ever had TB?	17 (4.0%)	406 (96.0%)	NA
Have you ever been tested for TB?	147 (34.8%)	276 (65.2%)	NA
Has one of your family members had TB?	29 (6.9%)	394 (93.1%)	NA
Are you vaccinated against TB (BCG vaccine)?	378 (89.4%)	Nil	45 (10.6%)
Have you ever received training on TB during your work in the hospital?	217 (51.3%)	189 (44.7%)	17 (4.0%)

BCG: bacille Calmette-Guerin; NA: not applicable; TB: tuberculosis

The overall knowledge of the study participants towards TB, MDR/XDR-TB was good. The knowledge among the study participants about the causative agent of TB, common symptoms, mode of transmission, diagnosis and management was more than 90%. However, a slightly lesser knowledge (86.8%) about the difference between latent TB infection and TB disease was noted. Although, the knowledge about MDR/XDR-TB and its mode of transmission was more than 95%, but a slightly lesser knowledge about the duration of treatment (84.9%) and the diagnostic modalities (87.9%) for MDR/XDR-TB was noted among the participants. 94.8% of the HCPs believed that MDR/XDR-TB is a genuine problem with serious public health concerns. Table

2 depicts the knowledge of the HCPs towards tuberculosis, MDR-TB/XDR-TB.

Table 2: Knowledge of HCPs about tuberculosis and MDR-TB/XDR-TB. (*n*=423)

Question	Correct response	Incorrect response	Not sure/ Don't know
What causes TB?	407 (96.2%)	09 (2.1%)	07 (1.7%)
What are the typical/common symptoms that are used as an indicator for active pulmonary TB?	402 (95.0%)	19 (4.5%)	02 (0.5%)
Can TB be completely cured?	412 (97.4%)	03 (0.7%)	08 (1.9%)
How is TB transmitted?	409 (96.7%)	09 (2.1%)	05 (1.2%)
What is the standard treatment for TB?	396 (93.6%)	08 (1.9%)	19 (4.5%)
How long does the standard treatment for drug-sensitive pulmonary TB usually take?	394 (93.1%)	11 (2.6%)	18 (4.3%)
What can happen if you take your TB drugs incorrectly/disrupt TB treatment?	399 (94.3%)	08 (1.9%)	16 (3.8%)
Who has a higher risk to get TB than average population?	415 (98.1%)	03 (0.7%)	05 (1.2%)
Can you get TB when you are vaccinated with BCG?	379 (89.6%)	21 (5.0%)	23 (5.4%)
Is there a relationship between HIV and TB?	381 (90.1%)	12 (2.8%)	30 (7.1%)
What is the most frequently used diagnostic laboratory test to diagnose TB?	407 (96.2%)	11 (2.6%)	05 (1.2%)
Do you know that causative agent of TB can be detected via PCR (GeneXpert) within 2-3 hrs?	370 (87.5%)	39 (9.2%)	14 (3.3%)
What is the difference between latent TB infection and TB disease?	367 (86.8%)	39 (9.2%)	17 (4.0%)
What is MDR-TB/XDR-TB?	402 (95.0%)	03 (0.7%)	18 (4.3%)
MDR-TB/XDR-TB is a genuine problem?	401 (94.8%)	05 (1.2%)	17 (4.0%)
How can you get MDR-TB/XDR-TB?	413 (97.6%)	03 (0.7%)	07 (1.7%)
Is MDR-TB/XDR-TB curable?	385 (91.0%)	17 (4.0%)	21 (5.0%)
Do you have knowledge about the treatment duration of MDR-TB/XDR-TB	359 (84.9%)	19 (4.5%)	45 (10.6%)
What are the diagnostic methods available for diagnosing MDR-TB/XDR-TB?	372 (87.9%)	37 (8.8%)	14 (3.3%)

BCG: bacille Calmette-Guerin; HCPs: health care professionals; HIV: human immunodeficiency virus; MDR: multi drug resistant; PCR: polymerase chain reaction; TB: tuberculosis; XDR: extensively drug resistant

Responses by HCPs to questions about their attitude towards TB are depicted in Table 3. While 341 HCPs (80.6%) agreed that they could get TB themselves, 49 (11.6%) believed that they could not be infected. The explanations given for this assumption was that they wear masks and other personnel protective equipment's while dealing with the suspected or confirmed TB cases. Some participants even claimed that they could not get infected as they have a good immunity. Majority (317; 74.9%) of the participants who agreed that they could get TB themselves, agreed that they were scared of getting TB and mentioned following reasons for the same: extent and severity of active TB infection; possibility of risk to infect a family member; prolonged anti tubercular therapy and/or associated adverse effects; risk of developing a

MDR/XDR-TB as they are continuously exposed to such patients. Associated social stigma, irreversible lung damage and fear of death were further reasons given by the HCPs. Most of the participants (407; 96.2%) agreed that they would keep seeing a friend who was diagnosed with TB; however, 387 (91.5%) said that they would not continue to use the same cutlery, plates and glasses if someone in their family/friend was infected with TB. 304 (71.9%) of the HCPs believed that there is still a social stigma associated with TB, whereas 107 (25.3%) of the participants believed that TB is no more a stigmatizing disease.

Except for 14 (3.3%) HCPs, all respondents said that they wished to learn more about TB; and 415 (98.1%) would approve to be screened for TB on regular basis. Five participants (1.2%) responded that they would not approve to get tested for TB regularly until they have any classical signs/symptoms of the disease. Most HCPs (403; 95.3%) believed that TB/MDR/XDR-TB is a global public health concern including India, and the newer diagnostic modalities to detect and differentiate between TB and MDR/XDR-TB need to be implemented particularly at primary and community health center level where the resources are limited. 413 (97.6%) HCPs agreed that there is a need for improvement in regional TB control particularly covering the rural population. The following measures were the most-frequently suggested ideas regarding the same: conduction of awareness campaigns; intensifying case finding; ensuring better drug compliance among the patients; improving the drug availability to patients.

Table 3: Attitudes of HCPs towards tuberculosis and MDR-TB/XDR-TB. (*n*=423)

Question	Yes	No	Not sure
Do you think you could get TB?	341 (80.6%)	49 (11.6%)	33 (7.8%)
Are you scared of getting TB?	317 (74.9%)	79 (18.7%)	27 (6.4%)
Would you continue to socialize with your friend, if he/she was diagnosed with TB?	407 (96.2%)	11 (2.6%)	5 (1.2%)
Would you share the same cutlery, plates and glasses with a friend/family member, if he/she were infected with TB?	24 (5.7%)	387 (91.5%)	12 (2.8%)
Would you say that TB is a stigmatized disease?	304 (71.9%)	107 (25.3%)	12 (2.8%)
Would you like to learn more about TB?	409 (96.7%)	11 (2.6%)	3 (0.7%)
Would you be willing to get tested for TB regularly?	415 (98.1%)	5 (1.2%)	3 (0.7%)
Do you feel TB/MDR-TB/XDR-TB is major threat to public health?	403 (95.3%)	17 (4.0%)	3 (0.7%)
Do you think there is a need of improvement in TB control in your region?	413 (97.6%)	8 (1.9%)	2 (0.5%)

MDR: multi drug resistant; PCR: polymerase chain reaction; TB: tuberculosis; XDR: extensively drug resistant

Table 4 depicts the various self-reported practices on attending, triaging, prioritizing the TB patients and the infection control measures practiced by HCPs. Most of the HCPs (378; 89.4%) would suspect TB infection in a patient presenting with a chronic cough, and 386 (91.3%) would separate them from other patients. About 415 (98.1%) HCPs reported to wear a facemask when being with a coughing patient, whereas 417 (98.6%) would wear one when dealing

with a confirmed TB infection patient. Ensuring cough hygiene by providing a mask to coughing patients was reported by by 350 (82.7%) participants. In order to increase the natural ventilation as an environmental TB control measure, 361 (85.3%) of the respondents would open windows and doors and only 107 (25.3%) would make use of a fan. Triage by prioritizing coughing patients was reported to be practiced by 316 (74.7%) HCPs. Patient education in terms of providing information about TB to newly diagnosed patients was practiced by 418 (98.8%) of the HCPs, and 401 HCPs (94.8%) admitted of giving cough hygiene instructions to patients, to prevent the disease transmission any further.

Table 4: Self reported practices on attending, triaging, prioritizing the TB patients and the infection control measures practiced by HCPs. (*n*=423)

Question	Never	Sometimes	Most of the times	Always
Suspecting TB in patients with chronic cough for ≥ 1 month	13 (3.1%)	32 (7.6%)	311 (73.5%)	67 (15.8%)
Triaging coughing patient from others	2 (0.5%)	35 (8.3%)	59 (13.9%)	327 (77.3%)
Wearing a mask while dealing with a coughing patient	Nil	8 (1.9%)	34 (8.0%)	381 (90.1%)
Wearing a mask while dealing with a confirmed TB patient	Nil	6 (1.4%)	16 (3.8%)	401 (94.8%)
Providing a mask to a coughing patient	27 (6.4%)	46 (10.9%)	59 (13.9%)	291 (68.8%)
Increasing cross ventilation when a TB patient is in room	25 (5.9%)	37 (8.8%)	63 (14.9%)	298 (70.4%)
Increasing ventilation by turning on a fan	14 (3.3%)	302 (71.4%)	43 (10.2%)	64 (15.1%)
Prioritizing coughing patients	39 (9.2%)	68 (16.1%)	55 (13.0%)	261 (61.7%)
Educating a newly diagnosed TB patient about his disease	Nil	5 (1.2%)	11 (2.6%)	407 (96.2%)
Educating a TB patient about cough etiquette to avoid transmission to others	6 (1.4%)	16 (3.8%)	57 (13.5%)	344 (81.3%)

TB: tuberculosis

Discussion

The current study aimed to assess the knowledge, attitude and practices towards TB, MDR/XDR-TB and to gain insight into currently practiced TBIC measures among the HCPs. The professional information about the study participants revealed that 29 of them had a family member with the history of having TB in past. 17 HCPs also gave a history of having TB in past and 13/17 such individuals were those who had a family member with TB history. Around 45% of HCPs admitted of not having received any special training on TB during their tenure in the hospital. Training programs for HCPs can surely increase their knowledge levels significantly. As the knowledge about the TB (particularly the epidemiology and the drug resistance) is evolving, TB training and periodic updates should be made available to all the HCPs. However such training can be tailored according to the need and the targeted

audience i.e. it may differ for doctors, nurses or paramedical staff.

In order to treat any disease effectively and efficiently, it is very important to have thorough knowledge about the same. TB is an ancient infectious disease with emerging threat of MDR/XDR-TB. Tuberculosis has always been amenable to change particularly with the advent of newer diagnostic techniques or the upcoming anti tubercular drugs like bedaquiline or delamanid. In the current study it was found that, though the correct knowledge of TB was present in majority of the study participants, the knowledge about the MDR/XDR-TB was comparatively less. Around 95% of the HCPs knew the definition of MDR/XDR-TB and also believed that it's a major public health concern, but gap in the knowledge about diagnosis and treatment was slightly higher. These deficits in the knowledge towards MDR/XDR-TB may contribute to the discordance between the prescribing practices and the treatment guidelines, which may potentiate the ongoing transmission of drug resistant TB.

Due to the high prevalence of drug resistant TB in India, undifferentiated clinical presentation between drug resistant and drug sensitive TB, and progressive decentralization required for drug resistant TB care, HCPs in all healthcare settings need to be well informed about the diagnosis and management of drug resistant/MDR/XDR-TB. Junior doctors and the nurses should be equipped with the adequate knowledge to diagnose, treat, and prevent transmission of TB/drug resistant TB at a primary care level.

Majority of the HCPs had an appropriate attitude towards TB. Around 81% of the HCPs believed that they can get TB and around 75% of them were scared of getting the disease. As HCPs are continuously exposed to the TB patients the probability of them getting infected is very high, particularly in a resource constrained setting where the TBIC measures are seldom practiced. Although around 96% of the participants admitted that they would continue to socialize with their friend, even if he/she is diagnosed with TB but around 92% admitted that they would not share the same cutlery, plates and glasses with a TB infected friend/family member, the finding that implies that still there are common knowledge gaps about the ways of TB transmission. This can promote the stigmatization as well as social exclusion/out casting of TB patients. Previous studies by Kwedi *et al.* and Woith *et al.* also noted the similar findings. [14,15] In the present study around 72% of the HCPs considered TB as a stigmatized disease. Previous study by Cremers *et al.* also noted the similar finding. [16] Majority of the respondents stated that they would like to learn more about TB and almost all the participants agreed to get themselves tested for TB on regular basis, a finding which was in tandem with previous study by Bhebhe *et al*. [17] Around 98% of the HCPs admitted that there is need for improvement in regional TB control and approximately 95% of the participants perceived that TB/MDR/XDR-TB is major public health threat. High awareness of the HCPs towards TB/MDR/XDR-TB being a serious health issue is a positive sign for effective implementation of the updated TBIC policies in future.

Until recently, the provision of effective first-line treatment was hoped to prevent the emergence of drug resistant TB. However, growing evidence suggests that person-to-person transmission, not just inadequate treatment, is driving the spread of drug resistance TB. Healthcare centers represent one of the important sites where drug resistant TB transmission occurs, particularly in settings where the TBIC measures are often poor/substandard, and the burden of TB is high. [18] In order to prevent the transmission of TB or drug resistant TB within any healthcare facility, implementation of recommended TBIC

measures is of utmost importance. At the same time it is equally important that the HCPs be well informed and updated about such measures.

Majority of the participants admitted that they wear a mask when dealing with a coughing patient as well as a patient with confirmed TB. However, since N-95 masks or the respirators were unavailable to most of them, so they were using surgical masks instead. It is important to note here that surgical masks are most appropriate when worn by the patient and do not give adequate protection to the HCPs, particularly against the MDR/XDR-TB. Use of N-95 masks is mandatory to prevent exposure with MDR/XDR-TB strains. A previous study by Buregyeya *et al*. has shown that only one third of the HCPs knew that a surgical mask would not adequately protect them to acquire TB from a patient. [19] Proper training programs regarding the adequate use of a mask and the appropriate kind of mask to be used by the patient and the attending HCPs would be helpful. Only about 69% of the HCPs reported to provide coughing patients with a surgical mask. The general lack of resources, particularly in primary healthcare centers and the fear of stigmatizing patients probably is the main reason for this finding. Only a minority of the respondents reported to turn on a fan in order to direct the airflow away from them when receiving a TB patient. Compared to mechanical ventilation, natural ventilation is not only highly efficacious but is economically advantageous as well and about 70% of the study participants reported to open doors and windows when dealing with an infectious TB patient. This possibly indicates awareness of most of the participants towards environmental measures. Nosocomial transmission of TB is directly proportional to the time a TB patient spends in a healthcare facility. Reducing the time a TB patient spends in any healthcare facility can surely prevent the transmission of TB within the facility and is one of the key recommendations of

the so called FAST strategy, an administrative approach to TBIC. [20] Our study findings indicate that most of the HCPs were not aware of the importance of this measure, as around 77% of them reported to prioritize coughing patients in the admission process. Once implemented into the patient management routine, this TBIC measure can prevent transmission within the facility, particularly in waiting areas, which generally tend to remain crowded for most of the time. Most of the HCPs admitted of educating the newly diagnosed patients about their disease and also about the proper cough etiquette. Educating the newly diagnosed TB patients about their disease is very important, they should be informed about the importance of good drug compliance, the possibility of reactivation/relapse and the development of drug resistance. This not only can ensure the better patient outcome but will also decrease the burden of disease in long run. Moreover educating the patients about the proper cough etiquette is also equally important as it may prevent the disease transmission to a great deal. [21]

Knowledge and awareness about the MDR/XDR-TB, its basic definition, prevalence, transmission dynamics, available diagnostic modalities, duration of treatment and possible outcomes is very important, particularly in high burden countries like India, where the risk of exposure to drug resistant strains is quite high. Disease burden can be lowered in any community by well-informed HCPs who can educate patients, as well as the general population about TB, increasing resistance, and emerging MDR/XDR-TB isolates. HCPs are the main avenue for creating awareness, and have a key role in the prevention and control of TB, more importantly of MDR/XDR-TB, hence their level of knowledge; attitude and practices towards the disease should be higher than others. A proportion of HCPs, particularly those with good knowledge, could also be motivated to adhere to the TBIC

guidelines with the provision of regular supervision and penalties on whether or not they adhere to the recommended guidelines.

Conclusion

It was observed in our study that HCPs had an overall good knowledge level, attitude and practices towards the TB, MDR/XDR-TB. However, some knowledge gaps and unacceptable attitudes were also found, particularly regarding diagnosis and management of MDR/XDR-TB. In order to further hone the professional knowledge and skills of the HCPs, the educational training and persuasive measures are certainly needed, but the effective implementation of strict administrative/organizational measures and TBIC measures are also required to curb down the incidence of TB and drug resistant TB. Moreover a stringent periodic assessment of the implemented measures is also essential to better guide the national TB control programs. Resources for effective TBIC should be made available in all healthcare facilities, particularly personal protective equipment such as N-95 masks for HCPs and adequate supply of surgical masks for visiting patients. Last but not the least, awareness campaigns should also be conducted among the HCPs as well as general population to clarify the misbeliefs about the associated social stigma with TB, which otherwise may hamper the TB control efforts.

Declarations

Availability of data and materials: The consent form, study questionnaire and the data used to support the findings of this study are available from the corresponding author on reasonable request.

References

1. Juyal D, Thaledi S. Same day sputum microscopy: Optimizing the diagnosis of pulmonary tuberculosis. OA Case Reports 2014 Mar 08;3(3):25

2. Kant K, Baveja CP, Sarkar J, Juyal D. Microbiological evaluation of clinically suspected cases of tubercular lymphadenopathy by cytology, culture, and smear microscopy – A hospital-based study from Northern India. J Family Med Prim Care 2019; 8:828-33

3. World Health Organization: Global Tuberculosis Report, 2018. Geneva, WHO; 2018. Available from: http://www.who.int/tb/publications/global_report/en/ [Last accessed on 2020 Nov 21]

4. Malhotra A, Kumar V, Juyal D, Gautam D, Malhotra R. Knowledge, attitude, and practices of health-care providers toward antibiotic prescribing, antibiotic resistance, and multidrug-resistant tuberculosis. Perspect Clin Res 2021; 12:146-52

5. Gandhi NR, Moll A, Sturm AW, Pawinski R, Govender T, Lalloo U, et al. Extensively drug-resistant tuberculosis as a cause of death in patients co-infected with tuberculosis and HIV in a rural area of South Africa. Lancet. 2006;368(9547):1575-80

6. Migliori GB, Ortmann J, Girardi E, Besozzi G, Lange C, Cirillo DM, et al. Extensively drug-resistant tuberculosis, Italy and Germany. Emerg Infect Dis. 2007;13(5):780-2

7. Companion Handbook to the WHO Guidelines for the Programmatic Management of Drug Resistant Tuberculosis. Geneva: World Health Organization; 2014. Available from: https://apps.who.int/iris/handle/10665/130918 [Last accessed on 2020 January 21]

8. Baussano I, Nunn P, Williams B, Pivetta E, Bugiani M, Scano F. Tuberculosis among health care workers. Emerg Infect Dis. 2011;17(3):488–94

9. Uden L, Barber E, Ford N, Cooke GS. Risk of Tuberculosis Infection and Disease for Health Care Workers: An Updated Meta-Analysis. Open Forum Infect Dis. 2017;4: ofx137

10. Javed H, Tahir Z, Hashmi HJ, Jamil N. A cross-sectional study about knowledge and attitudes toward multidrug-resistant and extensively drug-resistant tuberculosis in a high-burden drug-resistant country. Int J Mycobacteriol. 2016;5(2):128-34

11. Berg-Johnsen A, Hådem SO, Tamrakar D, Harstad I. A questionnaire of knowledge, attitude and practices on tuberculosis among medical interns in Nepal. J Clin Tuberc Other Mycobact Dis. 2020; 20:100173

12. Guidelines for the programmatic management of tuberculosis preventive treatment in India. National TB elimination programme, Central TB division, Ministry of Health and Family Welfare, Government of India, New Delhi. Available from: https://tbcindia.gov.in/index1.php?lang=1&level=1&sublinkid=4571&lid=3176 [Last accessed on 2020 January 25]

13. Guidelines for the programmatic management of drug resistant tuberculosis in India. National TB elimination programme, Central TB division, Ministry of Health and Family Welfare, Government of India, New Delhi. Available from: https://tbcindia.gov.in/index1.php?lang=1&level=1&sublinkid=4571&lid=3176 [Last accessed on 2020 January 25]

14. Kwedi Nolna S, Kammogne ID, Ndzinga R, Afanda B, Ntonè R, Boum Y, et al. Community knowledge, attitudes and practices in relation to tuberculosis in Cameroon. Int J Tuberc Lung Dis. 2016;20(9):1199–204

15. Woith W, Volchenkov G, Larson J. Barriers and motivators affecting tuberculosis infection control practices of Russian health care workers. Int J Tuberc Lung Dis. 2012;16(8):1092–6

16. Cremers AL, Janssen S, Huson MAM, Bikene G, Bélard S, Gerrets RPM, et al. Perceptions, health care seeking behaviour and implementation of a tuberculosis control programme in Lambaréné, Gabon. Public Health Action. 2013;3(4):328–32

17. Bhebhe LT, Van Rooyen C, Steinberg WJ. Attitudes, knowledge and practices of healthcare workers regarding occupational exposure of pulmonary tuberculosis. Afr J Prim Health Care Fam Med. 2014;6(1): E1–6

18. Gandhi NR, Weissman D, Moodley P, Ramathal M, Elson I, Kreiswirth BN, et al. Nosocomial transmission of extensively drug-resistant tuberculosis in a rural hospital in South Africa. J Infect Dis. 2013;207(1):9-17

19. Buregyeya E, Kasasa S, Mitchell EM. Tuberculosis infection control knowledge and attitudes among health workers in Uganda: a cross-sectional study. BMC Infect Dis. 2016;16(1):416

20. Barrera E, Livchits V, Nardell E. F-A-S-T: a refocused, intensified, administrative tuberculosis transmissi-on control strategy. Int J Tuberc Lung Dis. 2015;19(4):381-4

21. Mahgoob N., & Saber Ali D. M. Acute Appendicitis Due to Missed Intrauterine Contraceptive Device/A Case Report and Literature Reviews. Journal of Medical Research and Health Sciences, 2022;5(8);2177–2181.