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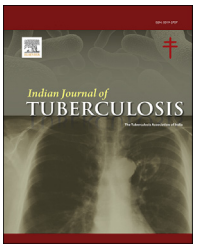

Original article

Risk factors and perceptions about coronavirus disease among tuberculosis patients in Delhi, India: A cross-sectional study

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ABSTRACT

Background: Tuberculosis (TB) and Coronavirus disease (COVID-19) co-infection can increase the severity among affected patients. This study was conducted to study the burden, risk factors and perceptions of COVID-19 among TB patients.

Methods: This was a cross-sectional study conducted among TB patients at one of the Directly Observed Treatment Short Course (DOTS) centre of Urban Primary Health Centre (UPHC) of Delhi, India. Information regarding socio–demographic profile, TB disease profile, history of COVID-19 and perceptions about TB and COVID-19 co-infection was collected. Descriptive analysis was performed.

Results: A total of 107 study participants were enrolled. Twenty-two TB patients (20.6%) never got tested for COVID-19. Two TB patients out of 107 study participants had COVID-19 in past. Both were males in age group of 30–44 years, had drug sensitive TB and were having pre-existing co-morbidities. Transmission routes of TB and COVID-19 were not known to about half of the study participants. Approximately 42.1% study participants perceived TB patients to be at higher risk of COVID-19 and majority study participants agreed that they should follow COVID-19 appropriate behaviour. However, helpline numbers for COVID-19 were not known to most of the study participants.

Conclusion: One-fifth of TB patients were never tested for COVID-19 inspite of the bi-directional screening guidelines for TB patients. Guidelines need to be practised stringently to find out true burden of co-infection. As the two TB patients who had COVID-19 in past already had other pre-existing co-morbidities as risk factors, whether TB enhances the risk for coronavirus infection independently needs further research.

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1. Introduction

In the year 2019, an estimated 10 million people fell ill with tuberculosis across the globe. South-East Asian region accounted for 44% of the global incidence. A reduction of 2.3% in incidence rate was noted between 2018 and 2019. There were an estimated 1.4 million TB deaths in world in 2019. The cumulative reduction in annual TB deaths between 2015 and 2019 was 14%. India contributed 26% to the global burden of this disease.[1]

COVID-19 pandemic, started in December 2019, has devastated many countries in the world. As of 2nd March, 2021, there were more than 113 million confirmed COVID-19 cases and 2.5 million deaths globally. India ranked second in terms of total cases and fourth in terms of total deaths during the same time period.[2] There is a threat that this pandemic could reverse the progress made in reduction of global TB burden. During 6-month period from January to June 2020, the overall reductions in reported number of people diagnosed with TB compared to the same period in the year 2019 were in the range 25–30% in few countries including India. This could substantially increase annual number of TB deaths.[1]

TB and COVID-19 are both respiratory infections affecting lungs but with slightly different routes of transmission. Infection control measures required for both these diseases are same including cough etiquette, handwashing, social distancing, regular cleaning of surfaces, prolonged quarantine, isolation and use of masks.[3] There is limited evidence relating to increased severity of COVID-19 among TB patients. The prevalence of TB among patients with COVID-19 has ranged from 0.37 to 4.47% in different studies.[4] Early reports show TB infection increases susceptibility to COVID-19 and its severity.[4,5] TB was found to be associated with 2.1 times increased risk of severe COVID-19 disease.[4] There is also a possibility that both TB and COVID-19 could exacerbate natural symptoms of other's and have negative impact on individual's health.[5] To counter this double menace of TB and COVID-19, Ministry of Health & Family Welfare, Government of India, released guidelines for bi-directional TB-COVID screening.[4]

However, there is limited literature available on risk factors of COVID-19 among TB patients in India. This study was therefore conducted to study the burden and risk factors of COVID-19 among TB patients. We also intended to find out the perceptions of TB patients and their family members about TB and COVID-19 co-infection. This can help in implementing the preventive approaches for COVID-19 among TB patients and in devising communication strategies to improve the knowledge about co-infection among diseased individuals.

2. Methods

This was a cross-sectional study conducted over two-months duration in the months of January and February, 2021, at one of the Directly Observed Treatment Short-Course (DOTS) centre at Urban Primary Health Centre (UPHC) of Delhi, India.

2.1. Study participants

TB patients registered at UPHC and their family members were included in the study. Family member was defined as first degree family member of TB patient who was residing with patient for more than 6 months.

2.2. Inclusion criteria

For TB patients- TB patients ≥15 years who had come to collect their medications on their own.

Family members- If family member had come to collect medications for the patient or for patients <15 years accompanied by family member.

2.3. Sample size

The sample size for the study was calculated using the formula for proportions i.e. $N= (Z_{1-\alpha/2})^2*p*(1-p)/d^2$.[6] Taking p as 0.50, as no previous literature was available regarding the burden of COVID-19 among TB patients and d as absolute precision of 10%, we arrived at a sample size of 97. A non-response rate of 10% was added to get a final sample size of 107.

2.4. Study tool

Semi-structured interviewer-administered questionnaire was used to gather information from study participants regarding socio–demographic profile of patient, TB disease profile, history of COVID-19 infection and testing in patient and perceptions about TB and COVID-19 co-infection. Socio-economic status was calculated using modified B. G. Prasad scale, which takes into account monthly per capita income, updated for the year 2020.[7] The questionnaire was pre-tested among 15 TB patients and was modified as per the findings from pre-testing. The data from pre-testing were not included in the final analysis.

2.5. Study technique

TB patients and their family members who came to collect medications from DOTS centre of the UPHC, were assessed for eligibility as per inclusion criteria. They were then invited to participate in the study and were explained the nature and purpose of the study. Informed consent was obtained from them. Thereafter, face-to-face interviews were conducted with study participants. Details related to TB disease profile were recorded from patient's treatment card available with patients and their family members. COVID-19 related information of the patient and perceptions were then asked from either the TB patients themselves or from their family members. Convenient sampling technique was used to include the study participants. All TB patients who were included in study and had themselves came to collect their medications were also asked to undertake rapid antigen testing available at no cost at UPHC. TB patients who were symptomatic, after undertaking test and testing negative, were asked to visit

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Medical Officer of the UPHC for further evaluation, treatment and management.

2.6. Data analysis

The data were entered into MS excel and analysed using SPSS. Descriptive analysis was performed. Categorical data were presented as frequencies and percentages and continuous data as mean. Random blood sugar at time of diagnosis was categorised as normal for levels of <140mg/dl, impaired if it was ≥140mg/dl but less than 200mg/dl and diabetic if it was ≥200mg/dl.[8]

2.7. Ethics

The study was conducted within the boundaries of Helsinki declaration. Permission to conduct study was obtained from institutional review board of the authors' institution. Informed consent was obtained from participants aged ≥18years, family members of paediatric TB patients and those who had come to collect medications on behalf of TB patient. Assent was obtained from TB patients of age ≤14years. Privacy and confidentiality of data was ensured.

Table 1 – Socio-demographic profile of TB patients (N = 107).

Variable	Frequency	Percentage
Age groups (in completed years)		
0–14	13	12.1
15–29	47	43.9
30–44	26	24.3
45–59	11	10.3
60–74	10	9.3
Gender		
Male	56	52.3
Female	51	47.7
Occupation		
Housewife	26	24.3
Unemployed	20	18.7
Student	20	18.7
Labour	16	15.0
Others	25	23.3
Educational status		
Illiterate	47	43.9
Primary	21	19.6
Middle	15	14.0
Secondary	7	6.5
Senior Secondary	12	11.2
Graduate	4	3.7
Not applicable (for patients age <7years)	1	0.9
Total number of family members		
Upto 4	34	31.8
5–8	61	57.0
9 or more	12	11.2
Socio-Economic Status[a]		
I	3	2.8
II	16	15.0
III	34	31.8
IV	37	34.6
V	17	15.9
Any co-morbidity		
Yes	26	24.3
No	81	75.7
If yes, which co-morbidity (n=26)[b]		
Diabetes Mellitus	8	30.8
Obesity	5	19.2
Hypertension	3	11.5
Chronic Obstructive Pulmonary Disease	3	11.5
Thyroid disorders	3	11.5
Chronic Kidney Disease	2	7.7
Epilepsy	2	7.7

[a] According to Modified B. G. Prasad scale for the year 2020.
[b] Multiple responses present.

3. Results

A total of 107 study participants were included in the study out of which 71 (66.4%) were patients themselves and 36 (33.6%) were first-degree family members of TB patients. Mean age of TB patients was 30.9 ± 15.4years (Range 6–68years). Mean weight of adult TB patients at time of diagnosis was 47.0 ± 10.8Kg (Range 25-90Kg) and of paediatric TB patients was 31.7 ± 12.1Kg (Range 12-50Kg).

Thirteen (12.1%) patients were paediatric TB cases and rest (87.9%, 94) were adults. Approximately 43.9% (47) were illiterate. About one-fourth TB patients (24.3%, 26) had some pre-existing co-morbidity and the most common co-morbidity was diabetes, followed by obesity and hypertension (Table 1).

Majority TB patients were new cases (78.5%, 84) and had drug sensitive disease (90.7%, 97). Human Immunodeficiency Virus (HIV) infection prevalence among TB patients was 0.9% (1). Thirty-four (31.8%) patients were ever tobacco users. Two patients (1.8%) had RBS levels at time of diagnosis in impaired range and 8 (7.5%) already diagnosed diabetic patients had their RBS levels ≥200mg/dl (Table 2).

One-fourth study participants (25.2%, 27) had one or more symptom of COVID-19 in last two weeks and the most common symptom was cough. About 79.4% (85) TB patients had ever got tested for COVID-19 and most of them (70.6%, 60) were last tested more than one month back (Table 2).

Only two patients had COVID-19 in past. Both were males, non-smokers, in age group of 30–44 years, and were having drug-sensitive TB. Out of them, one had COVID-19 before being diagnosed as pulmonary TB re-treatment case and was a known diabetic. The patient had uncontrolled diabetes at the time of diagnosis of TB and was having drug sensitive TB. One of his family member also developed COVID-19 later. The other one had it during the course of TB illness, and was a chronic kidney disease patient undergoing dialysis. He was having extra-pulmonary TB and was a new case.

According to study participants, the most common mode of transmission for TB was by sharing the food followed by respiratory route while for COVID-19 was respiratory route followed by touch. However, 51.4% (55) and 41.1% (44) study participants didn't know how does TB and COVID-19 spread, respectively. Forty-five (42.1%) study participants perceived TB patients to be at high risk of contracting coronavirus

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infection and 69 (64.5%) agreed that COVID-19 can complicate TB. However, 59.8% (64) didn't know if COVID-19 can affect TB treatment. Majority study participants acknowledged that TB patients should follow most of the COVID-19 appropriate behaviour. But more than half study participants (57.0%, 61) were in support of sharing the COVID-19 information from various communication channels without its verification. Twenty-four (22.4%) study participants agreed that tobacco use increases risk of both TB and COVID-19 (Table 3). Out of 71 TB patients, rapid antigen testing was done for 39 patients and none of them tested positive. Rest 32 TB patients didn't give consent for testing. The most common reasons for this were a recent COVID-19 test within past one month and not having any symptoms at present.

Table 2 – Disease profile of TB patients (N = 107).

Variable	Frequency	Percentage
Site of TB		
Pulmonary	64	59.8
Extra-pulmonary	43	40.2
Category		
New	84	78.5
Re-treatment	23	21.5
Phase of treatment		
Intensive	39	36.4
Continuation	68	63.6
Resistance pattern		
Sensitive	97	90.7
Drug resistant	10	9.3
Human Immunodeficiency Virus (HIV) status		
Reactive	1	0.9
Non-reactive	106	99.1
Random Blood Sugar levels at time of diagnosis		
Normal	97	90.7
Impaired	2	1.8
Diabetic	8	7.5
Last sputum result		
Not done	48	44.9
Negative	44	41.1
1+	10	9.3
2+	0	0
3+	5	4.7
Ever tobacco user		
Yes	34	31.8
No	73	68.2
Had COVID-19 like symptoms in past 14 days		
Yes	27	25.2
No	80	74.8
If yes, what symptoms (n=27)		
Cough	18	66.7
Fever	5	18.5
Shortness of breath	4	14.8
Ever got tested for COVID-19		
Yes	85	79.4
No	22	20.6
If yes, duration since last test (n=85)		
<1month	25	29.4
>1month	60	70.6
Result of most recent COVID-19 test (n=85)		
Positive	0	0
Negative	85	100
Ever had COVID-19 in past (n=85)		
Yes	2	98.1
No	83	1.9
Any family member had COVID-19 in past		
Yes	1	0.9
No	106	99.1

4. Discussion

The literature relating to TB and COVID-19 is limited in the country, but both infections affect the common organ, lungs and mode of transmission is slightly different. Nonetheless the infection control and preventive measures are more or less similar for both these diseases. This study therefore attempted to study the risk factors of COVID-19 among TB patients and their perceptions about the co-infection to aid in preventing co-occurrence of these diseases.

Out of 107 TB patients, 20.6% were never tested for COVID-19. Amongst those who were ever tested, mostly had their last COVID-19 test done more than 1 month back. As per guidelines from Ministry of Health and Family Welfare, Government of India, bi-directional screening is to be performed amongst all the patients of TB for COVID-19 and all COVID-19 patients who are symptomatic for TB.[4] This is essential to find out the true burden of co-infection as many symptoms for the two diseases overlap and might obscure the diagnosis of other, leading to delay in treatment initiation and increase in severity and complications. Missing the opportunity to test such patients for other infection could also aid in continued transmission of infection in the community. Therefore, the medical officers, the staff employed at DOTS centre, the personnel involved in testing patients for COVID-19 at the UPHC were sensitized about the co-infection of TB and COVID-19 and importance of bi-directional screening, after completion of the study. All the patients coming to DOTS centre were then counselled to get tested for COVID-19 and people getting tested for COVID-19 who had symptoms suggestive of TB were advised to get tested for TB at the DOTS centre.

In present study, two TB patients ever had COVID-19. COVID-19 developed during the course of TB treatment in one patient and before the diagnosis of TB in another patient, though he had been treated for TB in past also. This was in tune with the findings of previous studies[9,10] which concluded that COVID-19 can occur before, during or after the diagnosis of TB. There is usually some left-over damage in lungs post TB which might put TB survivors at high risk of severe COVID-19.[5] However, role of COVID-19 in development of active TB is yet to be ascertained.[9]

TB patients tend to have co-morbid conditions which further increase their vulnerability to coronavirus infection.[4] This was reiterated in our study as the two patients in present study who had COVID-19 in past had other existing co-morbidities (diabetes and chronic kidney disease). Previous studies have shown that diabetic individuals have three times more risk of having severe symptoms or die from COVID-19.[11] Also, both DM and CKD have been implicated as risk factors for severe COVID-19.[12] Whether the prevalence of COVID-19 found in present study could be attributed to TB or to pre-existing co-morbidities could not be commented upon and requires future research.

Approximately half of the study participants (51.1%) didn't know how does TB spread. This was much higher as

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Table 3 – Perceptions of TB patients and family members about TB and COVID-19 co-infection.

Variable	Patients (n = 71)	Family members (n = 36)	Total (N = 107)
TB spreads by[a]			
Sharing food	10 (14.1)	8 (22.2)	18 (16.8)
Respiratory route	10 (14.1)	6 (16.7)	16 (15.0)
Coughing/sneezing	10 (14.1)	4 (11.1)	14 (13.1)
Spitting	4 (5.6)	4 (11.1)	8 (7.5)
Talking	5 (7.0)	1 (2.8)	6 (5.6)
Close contact	2 (2.8)	2 (5.6)	4 (3.7)
Others	8 (11.3)	9 (25.0)	17 (15.9)
Don't know	40 (56.3)	15 (41.7)	55 (51.4)
COVID spreads by[a]			
Respiratory	11 (15.5)	11 (30.6)	22 (20.6)
Touch	13 (18.3)	8 (22.2)	21 (19.6)
Coughing/sneezing	11 (15.5)	6 (16.7)	17 (15.9)
Close contact	8 (11.3)	7 (19.4)	15 (14.0)
Sharing food	5 (7.0)	2 (5.6)	7 (6.5)
Others	8 (11.3)	5 (13.9)	13 (12.1)
Don't know	33 (46.5)	11 (30.6)	44 (41.1)
Patients with TB has high risk of contracting coronavirus infection			
Yes	28 (39.4)	17 (47.2)	45 (42.1)
No	13 (18.3)	7 (19.4)	20 (18.7)
Don't know	30 (42.2)	12 (33.3)	42 (39.3)
COVID-19 increase the complications among TB patients			
Yes	43 (60.6)	26 (72.2)	69 (64.5)
No	7 (9.9)	3 (8.3)	10 (9.3)
Don't know	21 (29.6)	7 (19.4)	28 (26.2)
COVID-19 can lead to treatment failure or longer duration of treatment for TB			
Yes	20 (28.2)	14 (38.9)	34 (31.8)
No	6 (8.5)	3 (8.3)	9 (8.4)
Don't know	45 (63.3)	19 (52.8)	64 (59.8)
TB patients should wear masks while being at public places			
Yes	70 (98.6)	36 (100)	106 (99.1)
No	1 (1.4)	0 (0)	1 (0.9)
Don't know	0 (0)	0 (0)	0 (0)
TB patients should follow social distancing even when they are wearing a mask			
Yes	61 (85.9)	34 (94.4)	95 (88.8)
No	9 (12.7)	2 (5.6)	11 (10.3)
Don't know	1 (1.4)	0 (0)	1 (0.9)
TB patients should follow cough etiquettes like coughing in elbow, washinghands after coughing and sneezing			
Yes	66 (93.0)	36 (100)	102 (95.3)
No	0 (0)	0 (0)	0 (0)
Don't know	5 (7.0)	0 (0)	5 (4.7)
TB patients should avoid physical contact with people to prevent COVID spread			
Yes	62 (87.3)	36 (100)	98 (91.6)
No	6 (8.5)	0 (0)	6 (5.6)
Don't know	3 (4.2)	0 (0)	3 (2.8)
TB patients should avoid touching eye, nose and mouth frequently to prevent COVID-19			
Yes	45 (63.4)	20 (55.6)	65 (60.7)
No	14 (19.7)	5 (13.9)	19 (17.8)
Don't know	12 (16.9)	11 (30.6)	23 (21.5)
TB patients should avoid non-essential travel to prevent COVID-19			
Yes	59 (83.1)	33 (91.7)	92 (86.0)
No	10 (14.1)	3 (8.3)	13 (12.1)
Don't know	2 (2.8)	0 (0)	2 (1.9)
TB patients should wash hands frequently to prevent COVID-19			
Yes	70 (98.6)	36 (100.0)	106 (99.1)
No	0 (0)	0 (0)	0 (0)
Don't know	1 (1.4)	0 (0)	1 (0.9)
TB patients should regularly clean frequently touched surfaces like door handles in view of COVID-19			
Yes	65 (91.5)	34 (94.4)	99 (92.5)
No	1 (1.4)	0 (0)	1 (0.9)
Don't know	5 (7.1)	2 (5.6)	7 (6.5)
COVID-19 related information from social media or other channels should be shared without verification			

(*continued on next page*)

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Table 3 – (*continued*)

Variable	Patients (n = 71)	Family members (n = 36)	Total (N = 107)
Yes	38 (53.5)	23 (63.9)	61 (57.0)
No	25 (35.2)	8 (22.2)	33 (30.8)
Don't know	8 (11.3)	5 (13.9)	13 (12.1)
Tobacco use increases the risk of			
Only TB	43 (60.6)	18 (50.0)	61 (57.0)
Only COVID-19	0 (0)	0 (0)	0 (0)
Both	14 (19.7)	10 (27.8)	24 (22.4)
None	2 (2.8)	0 (0)	2 (1.9)
Don't know	12 (16.9)	8 (22.2)	20 (18.7)
Know any helpline number in case you get COVID-19 or become symptomatic			
Yes	1 (1.4)	1 (2.8)	2 (1.9)
No	70 (98.6)	35 (97.2)	105 (98.1)

[a] Multiple responses present.

compared to the findings of Angelo AT et al and Dumpeti S et al in which 1–5% study participants didn't know about mode of transmission for TB. This could be due to different study population and higher literacy rates in their studies.[13,14] About 41.1% study participants didn't know how does COVID-19 spread. This was also higher as compared to the findings of other studies conducted in different parts of the country which showed majority study participants being well aware of mode of transmission for COVID-19. This could be because most of the studies were conducted among general population, majority were through online surveys and had higher number of literate participants.[15,16] Inadequate knowledge can be a barrier in fight against these diseases and can increase stigmatization as public awareness is vital to tackle infectious diseases.[17] Information about disease, its signs and symptoms is an important component of health education under prevention.

Around 40% study participants agreed that TB increases the risk of contracting COVID-19 infection and about two-third (64.5%) were of view that COVID-19 co-infection can increase complications among TB patients. As the early evidence showed increased negative health effects of TB and COVID-19 co-infection, it is important to make people aware about it through enhanced awareness campaigns. However, whether COVID-19 co-infection can have any effect on anti-TB treatment (ATT) was not known to about 59.8% study participants. It has been anticipated that co-infection with COVID-19 among TB patients can lead to more severe outcomes if ATT is discontinued and will lead to continued TB infection transmission in community.[3,18] The importance of continuing ATT even in cases of co-infection should be stressed upon[4,18] and communicated to TB patients and their family members.

Majority of the study participants answered affirmatively when asked should TB patients follow COVID-19 appropriate behaviour to prevent co-infection. COVID-19 appropriate behaviour should not be compromised by TB patients even if they are on treatment for TB as impact of COVID-19 on people with TB and on treatment is not yet completely known.[5] However, approximately half of the study participants said that COVID-19 related any information should be shared without verification. In this era of infodemic, misinformation spreads speedily. Misinformation contributes to spread of COVID-19, might increase fear, lead to social disaccord, and can also cause direct damage by delaying care-seeking, or wrong medical treatment.[19,20] Quality-information guided citizen actions are crucial for the successful global response to this pandemic.[21] Public should be educated about the ill-effects of misinformation and should be encouraged to verify any information before circulating it on social media or other media channels. Helpline numbers should be more aggressively communicated as majority study participants were not aware of any helpline numbers for COVID-19, which could be due to high rates of illiteracy in present study. These helplines can also be used to counter myths related to co-infection and disseminate correct information. Frequent health talks were organized at the UPHC to spread awareness about COVID-19 and dangers of mis-information. TB patients and their family members visiting DOTS centre at the UPHC were also sensitized regularly about the possibility and complications associated with co-infection, importance of treatment compliance and covid appropriate behaviour.

Only one-fifth (22.4%) study participants knew that tobacco use increases the risk of both TB and COVID-19 and 31.8% were ever tobacco users. Tobacco is an independent risk factor of TB[5,22,23] and evidence has shown smoking increases the risk of COVID-19.[5] Therefore, tobacco cessation programs and centres are vital to address this problem and can reduce the burden of both the infections. TB and COVID-19 patients should be counselled to quit tobacco as it can improve the treatment outcome and decrease the disease severity for both infections.[5,23] A non-communicable diseases (NCD) clinic is functional at the UPHC for early screening, prevention and control of common NCDs. Tobacco cessation counselling is an integral part of this NCD clinic and tobacco users are regularly counselled about quitting tobacco.

4.1. *Strengths*

To the best of our knowledge, this is amongst the few early studies conducted to assess the burden, risk factors and perceptions about COVID-19 among TB patients in India. Face-to-face interviews were conducted thereby reducing selection bias inherent in online surveys. Information was collected by a single investigator so information bias was minimized.

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4.2. *Limitations*

There are few limitations of the present study. It was a cross-sectional study so temporal relationship could not be established. The sample size was small and study population comprised of semi-urban population from a single DOTS centre. Therefore, findings cannot be generalised to other sections of population. There is also a possibility of recall bias. As some of the data were self-reported, reporting bias couldn't be ruled out.

5. Conclusion and recommendations

One-fifth of TB patients were never tested for COVID-19 inspite of the bi-directional screening guidelines for TB patients. Guidelines need to be practised stringently to find out true burden of co-infection. As the TB patients who had COVID-19 in past already had other pre-existing co-morbidities, whether TB enhances the risk for COVID-19 independently needs further research. Approximately 42.1% study participants perceived TB patients to be at higher risk of COVID-19, they should be made aware about severity of co-infection and whom to contact in case of symptoms suggestive of COVID-19. Majority agreed that TB patients should keep following COVID-19 appropriate behaviour but more than half acknowledged that COVID-19 related information should be shared without verification. Therefore, harms of misinformation should be communicated to them.

Conflicts of interest

The authors have none to declare.

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