

Psychological morbidity and quality of life of patients with pulmonary tuberculosis

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Abstract

Tuberculosis (TB) is associated with psychological distress, poor coping, deterioration in health-related quality of life (HRQL), and stigma. However, these issues have never received sufficient attention as part of routine care. The healthcare workers and physicians of primary contact are not sensitized to use discrete screening questionnaires to identify and address these issues.

A longitudinal study was hence conducted in the Department of Pulmonary Medicine in collaboration with the Department of Psychiatry. 75 microbiologically confirmed 'new' pulmonary TB patients were enrolled. Socio-demographic and clinical details were noted. The patients were then evaluated for psychological distress using the General Health Questionnaire-12 Hindi version (GHQ-12) and Patient Distress Thermometer (PDT); coping strategies using the Coping Strategy Check List Hindi version (CSCL); HRQL using the World Health Organization Quality of Life-Brief Hindi version (WHOQOL-Bref), and stigma using the Explanatory Model Interview Catalogue-affected persons Stigma Scale (EMIC-SS) at the start of treatment. Those having a GHQ-12 score ≥ 3 were labeled as 'screen positive' for psychological distress and referred to a consultant psychiatrist for a detailed psychological assessment. Treatment was given by the psychiatrist if diagnosed with a psychiatric illness. All those without a diagnosis of a psychiatric illness were counseled by a pulmonologist. All patients were called for a follow-up visit and repeat assessments on the 15th day at the end of the intensive phase, using the same instruments employed at baseline. The patients already on treatment by the psychiatrist were again evaluated for their psychiatric illness.

32 (42.7%) patients had psychological distress (GHQ-12 ≥ 3) at baseline. 20 of them (26.7%) were diagnosed with a psychiatric illness. However, only 2 (2.7%) patients had psychological distress and psychiatric illness at follow-up ($p < 0.001$). Mean scores of GHQ-12, PDT, CSCL, WHOQOL-Bref-26, and EMIC-SS at baseline were 3.000 ± 1.9590 , 2.333 ± 1.2980 , 3.480 ± 2.2017 , 311.63 ± 30.201 and 5.267 ± 1.8478 , respectively. All the scores improved significantly at follow-up ($p < 0.001$). The scores of the various instruments used in the study significantly correlated with each other.

Comprehensive screening for psychological distress and assessment of HRQL should be part of routine TB care. The healthcare workers under the program should be sensitized to use the various screening tools on a day-to-day basis to identify patients who require expert psychiatric care. The majority of the patients with distress, but without a psychiatric illness, can be handled well with dedicated counseling sessions by the healthcare workers themselves. The ancillary staff should be encouraged and trained to meet the demands in resource-constrained settings. A multidisciplinary approach, with close integration of TB programs with mental health services, is urgently required to eliminate TB.

Key words: TB, psychological distress, HRQL, screening tools.

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Introduction

Tuberculosis (TB) is known to be associated with stigma and affects health-related quality of life (HRQL) badly [1,2]. However, despite the incorporation of novel patient-friendly measures for treatment delivery to deal with stigma, patients still suffer from psychological morbidities and poor HRQL [1,2].

Assessment of psychological distress and HRQL as a part of routine care is rarely carried out [3]. Physicians of primary contact lack knowledge about the readily available and easy-to-use

screening tools and are not sensitized to use them on a day-to-day basis. Other reasons for non-assessment include busy outpatient departments and fear of infection during verbal interactions. There is poor patient acceptance for the diagnosis of psychological comorbidities. Hence, psychological morbidities remain unidentified and undertreated, leaving a majority to cope with the mental health issues either on their own or with a little help from the members of their social circle. Lack of appropriate counselling and/or expert psychiatrist advice complicates the management of the underlying disease as well, and indirectly



contributes to poor treatment outcomes [3-6]. The situation is even grimmer in the Indian sub-continent when compared with the global scenario, because of the huge burden of TB and scarce resources, while planning for any multidisciplinary approaches.

A study was hence planned to estimate the burden of psychological distress and assess HRQL in patients suffering from pulmonary TB with the use of authenticated screening tools. Expert psychiatric opinion was sought for the identification of psychiatric illness in patients showing psychological distress on screening. Assessments were repeated after the end of the intensive phase (IP) of treatment to study the improvements in underlying disease, psychological distress, coping, and HRQL.

Materials and Methods

A longitudinal study was conducted in the Department of Pulmonary Medicine in collaboration with the Department of Psychiatry. 75 microbiologically confirmed 'new' pulmonary TB patients (by sputum smear microscopy/cartridge-based nucleic acid amplification test) were enrolled in the study. Considering the prevalence of psychological distress and a follow-up period of 2 months, the sample size was calculated as 66. Keeping in mind the possible attrition, it was decided that 75 patients would be included.

Exclusion criteria

Patients aged <18 years, those with a history of anti-tubercular treatment in the past, pregnant and lactating females, those who refused consent, patients with pre-existing psychiatric illness, those who did not have capacity, or those who were critically ill were excluded from the study. The retreatment cases were excluded from the study because it is expected that the patients with a previous course of complete/incomplete anti-tubercular treatment for TB will behave differently while carrying out assessment for the indices under consideration. Since they have already faced a challenge earlier, their positive and negative thought processes may differ depending on the outcomes during their previous course of treatment, and hence may provide an over-/underrated measurement of psychological distress, coping, HRQL, and stigma.

After enrollment, on day 15 from the date of diagnosis, a specially designed structured proforma was used to record the relevant history, socio-demographic data, and clinical details. The patients were then evaluated for psychological distress using General Health Questionnaire-12 Hindi version (GHQ-12) and Patient Distress Thermometer (PDT); coping strategies by using Coping Strategy Check List Hindi version (CSCL); HRQL by using World Health Organization Quality of Life-Brief Hindi version (WHOQOL-Bref), and stigma by using Explanatory Model Interview Catalogue affected persons Stigma Scale (EMIC-SS). Those having GHQ \geq 3 were labeled as 'screen positive' for psychological distress and referred to a consultant psychiatrist for a detailed psychological assessment. Treatment was given by the psychiatrist if diagnosed with a psychiatric illness, as per individual needs. Depending on the severity of the illness, medications, brief counselling, supportive psychotherapy, or a combination were chosen. All those without the diagnosis of a psychiatric illness were counselled by the pulmonologist about the cause, course, and management of TB in detail, and the need to remain compliant with treatment.

All the patients were called for a follow-up visit on the 15th

day of the end of IP, and reassessment was carried out using all the instruments that were used at baseline. The patients already on treatment by the psychiatrist were again evaluated for their psychiatric illness.

Scales

GHQ-12: this is a 12-item screening instrument, validated to measure psychological distress in the Indian population. Any participant scoring ≥ 3 was defined as a case with psychiatric morbidity [7].

PDT: a modified visual analogue scale that resembles a thermometer, ranges from 0 to 10, and is used to assess patients for distress [8].

CSCL: a self-administered scale, comprising 36 coping strategies used to deal with stressful situations, and indicates their use in day-to-day life [9].

WHOQOL-Bref: it contains a total of 26 questions and is used to assess HRQL [10].

EMIC-SS: it is used to study stigmas produced by various neglected diseases and conditions, including TB [11].

The data so obtained, at the two points of assessment, were tabulated and statistically analyzed. The patients who needed a change in anti-tubercular treatment due to any reason, were detected with drug resistance at any point, or dropped out during the follow-up period, were excluded from the study. Thus, only those 75 patients who could complete the follow-up assessments were included in the final analysis.

The study was approved by the institute's Ethics committee vide letter no. Trg.9(310)2022/24733 dated 27-07-2022.

Statistical analysis

Normality of quantitative data was checked using the Kolmogorov-Smirnov test of normality. Our variables were non-normally distributed (skewed), so they were represented as mean and standard deviation with median and interquartile range; comparisons for two groups (GHQ-12<3 and ≥ 3 , and also presence/absence of psychiatric illness) were made by the Mann-Whitney U test. For time-related variables of skewed data, the Wilcoxon signed rank test was applied (comparison of variables of baseline data with follow-up variables). The Spearman correlation coefficient was calculated to see the relation between different variables (quantitative data).

Categorical variables were reported as counts and percentages. Group comparisons were made with the Chi-square test if all expected cell frequencies were more than 5 and Fisher's exact test when expected cell frequencies were less than 5.

All the statistical tests were two-sided and were performed at a significance level of $\alpha=0.05$. Analysis was conducted using IBM SPSS STATISTICS version 22.0 (IBM Corp., Armonk, NY, USA).

Results

The socio-demographic, clinical, and psychological variables of all the patients are depicted in Table 1. It was seen that 32 (42.7%) patients had psychological distress (GHQ-12 ≥ 3) at baseline. Out of them, 20 (26.7%) were diagnosed with a psychiatric illness. However, only 2 (2.7%) patients had psychological distress and psychiatric illness at follow-up. GHQ-12 scores were unaffected by age ($p=0.627$), gender ($p=0.4$), demography (0.963), occupation ($p=0.574$), family income ($p=0.578$), comor-



bidities ($p=0.103$), and addiction ($p=0.589$). Table 2 shows that a significantly smaller number of patients had psychological distress and psychiatric illness at follow-up ($p<0.001$). Table 3 shows the mean scores of GHQ-12, PDT, CSCL, WHOQOL-Bref-26, and EMIC-SS at baseline and at follow-up. All the scores improved significantly at follow-up ($p<0.001$). Table 4 shows the correlation of different scales with each other. GHQ-12 correlated positively with PDT, CSCL, and EMIC-SS, and negatively with WHO-QOL-Bref-26. The various scales also correlated significantly with each other.

Discussion

Infectiousness of the disease, perceived fear of transmission, physical disability, pill burden, withdrawal from interpersonal relationships, discrimination, age-old stigma, health disparities, and social and economic consequences contribute to psychological comorbidities and poor HRQL in patients with TB. However, despite massive leaps in the diagnosis and treatment strategies, mental health issues have remained grossly unidentified and unaddressed, and pose a serious threat to TB elimination programs [12].

Table 1. Socio-demographic, clinical and psychological variables of the patients (n=75).

Variable	n (%)	
Age	18-30 years	32 (42.6)
	31-40 years	11 (14.7)
	41-50 years	11 (14.7)
	51-60 years	6 (8.0)
	61-70 years	9 (12.0)
	>70 years	6 (8.0)
Gender	Female	31 (41.3)
	Male	44 (58.7)
Demography	Rural	26 (34.7)
	Urban	49 (65.3)
Occupation	Skilled work	9 (12.0)
	Manual work	24 (32.0)
	Student	8 (10.7)
	Unemployed	34 (45.3)
Comorbidities	Yes	11 (14.7)
	No	64 (85.3)
Addiction	Yes	21 (28.0)
	No	54 (72.0)
GHQ-12 ≥ 3 at baseline (presence of psychological distress)	Yes	32 (42.7)
	No	43 (57.3)
GHQ-12 ≥ 3 at follow-up (presence of psychological distress)	Yes	2 (2.7)
	No	73 (97.3)
Presence of psychiatric illness at baseline	Yes	20 (26.7)
	No	55 (73.3)
Presence of psychiatric illness at follow-up	Yes	2 (2.7)
	No	73 (97.3)

GHQ-12, General Health Questionnaire-12 Hindi version.

Table 2. Number of patients with the General Health Questionnaire-12 <3 and ≥ 3 at baseline and at follow-up; and number of patients without and with psychiatric illness at baseline and at follow-up.

		Baseline GHQ-12 vs. Follow-up GHQ-12			p
		<3	≥ 3	Total	
Baseline GHQ-12	<3	43	0	43	<0.001
	≥ 3	30	2	32	
	Total	73	2	75	
Baseline psychiatric illness vs. follow-up psychiatric illness					
		Follow-up psychiatric illness			
		No	Yes	Total	p
Baseline psychiatric illness	No	55	0	55	<0.001
	Yes	18	2	20	
	Total	73	2	75	

GHQ-12, General Health Questionnaire-12 Hindi version.



Table 3. Mean scores of the different screening questionnaires at baseline and at follow-up.

Screening questionnaire	Baseline Score (mean \pm standard deviation)	Follow-up Score (mean \pm standard deviation)	p
GHQ-12	3.000 \pm 1.9590	1.053 \pm 0.7866	<0.001
PDT	2.333 \pm 1.2980	0.960 \pm 0.7060	<0.001
CSCL	3.480 \pm 2.2017	1.387 \pm 0.9138	<0.001
WHOQOL-Bref	311.63 \pm 30.201	403.36 \pm 16.663	<0.001
EMIC-SS	5.267 \pm 1.8478	2.800 \pm 0.9005	<0.001

GHQ-12, General Health Questionnaire-12 Hindi version; PDT, Patient Distress Thermometer; WHOQOL-Bref, World Health Organization Quality of Life- Brief Hindi version; CSCL, Coping Strategy Check List Hindi version; EMIC-SS, EMIC affected persons Stigma Scale.

Table 4. Correlation of different questionnaires with each other.

	GHQ-12	PDT	CSCL	WHOQOL-Bref	EMIC-SS
GHQ-12	Correlation coefficient	1.000	0.570**	0.509**	-0.750**
PDT	Correlation coefficient	0.570**	1.000	0.486**	-0.478**
CSCL	Correlation coefficient	0.509**	0.486**	1.000	-0.333**
WHOQOL-Bref	Correlation coefficient	-0.750**	-0.478**	-0.333**	1.000
EMIC-SS	Correlation coefficient	0.582**	0.486**	0.402**	-0.377**
					1.000

GHQ-12, General Health Questionnaire-12 Hindi version; PDT, Patient Distress Thermometer; WHOQOL-Bref, World Health Organization Quality of Life- Brief Hindi version; CSCL, Coping Strategy Check List Hindi version; EMIC-SS, EMIC affected persons Stigma Scale. **Correlation is significant at the 0.01 level (2-tailed).

This study was the first of its kind from the Indian subcontinent to use a variety of discrete screening tools for assessment of psychological distress, coping strategies, HRQL, and stigma in patients suffering from pulmonary TB. It provides valuable insights into the burden of psychological trauma that TB patients may be going through, coping methods, and the impact on the HRQL. 42.7% of the patients were from the highly productive age group of 18-30 years. 58.7% were males, and 65.3% were from an urban background. The majority of the patients were not suffering from any comorbid illness. All patients showed clinical, radiological, and bacteriological response to anti-tubercular treatment at the end of the IP of treatment.

GHQ-12 is an easy-to-administer screening tool that can be used by the health care workers of primary contact to screen for the presence of psychological distress, and has been validated in the Indian population. In this study, GHQ-12 scores were unaffected by age, gender, demography, occupation, family income, comorbidities, and addiction habits.

It was seen that out of 42.7% of the patients who were suffering from psychological distress, 26.7% were diagnosed with a psychiatric illness and needed treatment by an expert psychiatrist. If left untreated, they would have required additional resources for management and could have added to the morbidity and mortality. However, timely treatment by the psychiatrist was effective in decreasing the burden of psychiatric illness at follow-up. Additionally, in patients with psychological distress but without psychiatric illness, counselling by the pulmonologist was highly fruitful, as there was a statistically significant decrease in the number of patients left with psychological distress at follow-up. Global data with respect to the burden of psychological comorbidities and their assessment methods are highly variable [3,13-19]. Similar reduction in psychological comorbidity at follow-ups has been noted in the past, however, with the use of different instruments [5,13,16,18].

Routine screening with such quick and easy-to-use screening questionnaires should become a part of the routine management of patients with TB and should be incorporated into the program. The healthcare workers and physicians of primary contact should be sensitized to administer these tools. If screen positive, they can be thoroughly dealt with by an expert psychiatrist, as some of these patients may require medications for mental well-being, psychotherapy, or need-based individualized therapies. At the same time, this study suggests that educational and counseling sessions should be provided by the physician/HCW at the point of first contact, as it is highly successful in significantly decreasing the psychological distress in most patients.

This study also measured psychological distress using another easy-to-use tool, the PDT. The psychological distress measured by PDT correlated well with the distress measured by the GHQ-12. Hence, PDT also emerged as a handy tool for screening for psychological distress in patients with TB, on a routine basis.

It is seen that in any situation wherein an individual faces any physical stress/illness, a variety of coping mechanisms are generated within to deal with the same. However, the extent of coping behaviors varies from one individual to another, and such differences differently impact the course of mental and physical health. It was seen that the coping scores, as measured by CSCL in the patients of TB in this study, were poorer at baseline and improved markedly at follow-up. The contribution of an expert psychiatrist and the counselling by the pulmonologist thus turned out to be noteworthy in coping with TB over a period of time. Very few studies have examined the coping strategies in TB and have focused primarily on the financial aspect [20,21]. Detailed work-up, as in this study, through a standardized instrument, CSCL, has not been done in the past in patients with TB.

On a similar front, in such situations of physical stress/illness, as posed by TB, it is expected that the HRQL is deteriorated.



Physical constraints and a variety of behavioral negativities due to the inherent nature and course of the disease contribute to poor HRQL, and the same was revealed by WHOQOL-Bref scores in this study. Again, the improvement of the scores at follow-up reinforces the role of early management by the primary care physician alone or in collaboration with a psychiatrist. Similar decline in HRQL across all domains (physical, economic, and psychosocial) has been reported in the past, and it has also been emphasized that there is a need to develop, standardize, and validate a TB-specific HRQL assessment tool [5,17,18,22,23].

Despite the well-known fact that TB leads to stigma, there are very few studies that have used validated and reliable tools to identify and quantify the same. This study made a small attempt to measure the same with the use of EMIC-SS. The magnitude of stigma was higher at baseline and alleviated significantly at follow-up, again emphasizing the need for counseling sessions and a multidisciplinary approach, right from the time of diagnosis, and as a part of routine care. Similar results, with a need to develop practical tools to measure TB-related stigma and evaluate the impact of stigma-reduction interventions on TB elimination programs, have been repeatedly stressed in the existing literature [17,24-26].

This study also analyzed the correlation of various scales at baseline. GHQ-12 Hindi version correlated positively with PDT, CSCL, and EMIC-SS, and negatively with WHOQOL-Bref-26. The various scales also correlated significantly with each other. This finding suggests that in patients with higher psychological distress (higher GHQ-12 Hindi version and PDT scores), there is significantly poorer coping (higher CSCL scores), significantly poorer HRQL (lower WHOQOL-Bref-26 scores), and significantly higher stigma (higher EMIC-SS scores). Hence, any of these scales can be used as a surrogate for one another, alone as well as in combination, as per need or when there are time constraints, and can provide a reliable idea of the varied spectrum of mental health issues. Counselling and/or psychiatric help at the point of first contact, after proper identification of the mental health issues with these tools, is deemed to improve coping, HRQL, stigma, and overall psychological well-being.

While aiming for TB elimination in the coming years, it is necessary to manage the disease at the time of diagnosis itself, in totality, and including mental health issues. Such efforts will decrease non-compliance to treatment, delays in health care seeking, and the spread of disease to the community. There will be an additional impact on overall productivity, with favorable socio-economic consequences and a decrease in morbidity and mortality.

Strengths of the study

The study was the first of its kind. Multiple scales were administered to study the different aspects of psychological suffering. Being a longitudinal study, the follow-up assessments helped identify the role of directed counselling sessions and expert psychiatrist consults on a variety of psychological parameters and HRQL. Such an attempt has never been made in the Indian context.

Limitations of the study

The sample size was small. The follow-up period was till the end of the IP of treatment. A longitudinal study with a longer follow-up period and a larger sample size is needed to elucidate the various psycho-social relationships of TB to a greater extent, and in a broader perspective.

Conclusions

There is an urgent need to identify psychological comorbidities at the time of diagnosis of TB. Under the national program, the physician/HCW of first contact should be made 'able' to confidently use the various available and validated screening instruments as a part of routine care. They should be able to identify and refer the few patients who require expert care from a psychiatrist, and should be able to manage the remaining majority with the use of dedicated educational and counselling sessions, on their own, or with the help of ancillary staff. A psychiatrist should be made an integral part of the multidisciplinary care model. Research should be promoted to develop TB-specific screening instruments. The policy makers should focus on developing and integrating additional 'TB-mental health' strategies into routine TB care, as mental well-being is emerging as an important determinant of TB outcomes.

References

- Chen X, Du L, Wu R, et al. Tuberculosis-related stigma and its determinants in Dalian, Northeast China: a cross-sectional study. *BMC Public Health* 2021;21:6.
- Ashaba C, Musoke D, Wafula ST, Konde-Lule J. Stigma among tuberculosis patients and associated factors in urban slum populations in Uganda. *Afr Health Sci* 2021;21:1640-50.
- Agarwal N, Sarthi P. The necessity of psychological interventions to improve compliance with Tuberculosis treatment and reduce psychological distress. *J Family Med Prim Care* 2020; 9:4174-80.
- Duko B, Dana LM, Ayano G. Psychological distress among TB patients in sub-Saharan Africa. *Int J Tuberc Lung Dis* 2020; 24:1200-4.
- Febi AR, Manu MK, Mohapatra AK, et al. Psychological stress and health-related quality of life among tuberculosis patients: a prospective cohort study. *ERJ Open Res* 2021;7:00251-2021.
- Roy N, Krishnamoorthy Y, Rajaa S, et al. Health-related quality of life and its effect on TB treatment outcomes. *Int J Tuberc Lung Dis* 2021;25:318-20.
- Mattoo SK, Handa S, Kaur I, et al. Psychiatric morbidity in vitiligo: prevalence and correlates in India. *J Eur Acad Dermatol Venereol* 2002;16:573-8.
- Rajpoot A, Garg K, Saini V, Gupta N. Psychological morbidity in interstitial lung disease: a study from India. *Monaldi Arch Chest Dis* 2020;90:1434.
- Sharma Y, Mattoo SK, Kulhara P, et al. Stress and coping in women with cervical and breast cancer in India. *German J Psychiatry* 2003;6:40-8.
- Development of the World Health Organization WHOQOL-BREF quality of life assessment. The WHOQOL Group. *Psychol Med* 1998;28:551-8.
- Frota da Rocha Morgado F, Kopp Xavier da Silveira EM, Pinheiro Rodrigues do Nascimento L, et al. Psychometric assessment of the EMIC Stigma Scale for Brazilians affected by leprosy. *PLoS One* 2020;15:e0239186.
- Courtwright A, Turner AN. Tuberculosis and stigmatization: pathways and interventions. *Public Health Rep* 2010;125:34-42.
- Rouf A, Masoodi MA, Dar MM, et al. Depression among Tuberculosis patients and its association with treatment outcomes in district Srinagar. *J Clin Tuberc Other Mycobact Dis* 2021;25:100281.



14. Peltzer K, Naidoo P, Matseke G, et al. Prevalence of psychological distress and associated factors in tuberculosis patients in public primary care clinics in South Africa. *BMC Psychiatry* 2012;12:89.
15. Chen X, Wu R, Xu J, et al. Prevalence and associated factors of psychological distress in tuberculosis patients in Northeast China: a cross-sectional study. *BMC Infect Dis* 2021;21:563.
16. Tola HH, Shojaeizadeh D, Garmaroudi G, et al. Psychological distress and its effect on tuberculosis treatment outcomes in Ethiopia. *Glob Health Action* 2015;8:29019.
17. Chen X, Xu J, Chen Y, et al. The relationship among social support, experienced stigma, psychological distress, and quality of life among tuberculosis patients in China. *Sci Rep* 2021; 11:24236.
18. Peddireddy V. Quality of life, psychological interventions and treatment outcome in tuberculosis patients: the Indian scenario. *Front Psychol* 2016;7:1664.
19. Ayana TM, Roba KT, Mabalhin MO. Prevalence of psychological distress and associated factors among adult tuberculosis patients attending public health institutions in Dire Dawa and Harar cities, Eastern Ethiopia. *BMC Public Health* 2019; 19:1392.
20. Ayé R, Wyss K, Abdualimova H, Saidaliev S. Factors determining household expenditure for tuberculosis and coping strategies in Tajikistan. *Trop Med Int Health* 2011;16:307-13.
21. Yellappa V, Lefèvre P, Battaglioli T, et al. Coping with tuberculosis and directly observed treatment: a qualitative study among patients from South India. *BMC Health Serv Res* 2016;16:283.
22. Yasobant S, Nazli Khatib M, Syed ZQ, et al. Health-related quality of life (HRQoL) of patients with tuberculosis: a review. *Infect Dis Rep* 2022;14:509-24.
23. Rachmawati DS, Nursalam N, Hargono R, Widjanarko Otok B. Quality of life and subjective well-being modeling of pulmonary tuberculosis patients. *J Public Health Res* 2021;10:2180.
24. Kumari Indira KS, Mathew N. TB related stigma and gender disparity among unaffected population in central Kerala, a survey. *Indian J Tuberc* 2023;70:168-75.
25. Chiang SS, Zeng C, Roman-Sinche B, et al. Adaptation and validation of a TB stigma scale for adolescents in Lima, Peru. *Int J Tuberc Lung Dis* 2023;27:754-60.
26. Nuttall C, Fuady A, Nuttall H, et al. Interventions pathways to reduce tuberculosis-related stigma: a literature review and conceptual framework. *Infect Dis Poverty* 2022;11:101.

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