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Table of Contents

Contents Continued on IBC

Volume 71, No. S2 | 2024

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Psychological Disorders in Tuberculosis and Respiratory diseases

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Contents Continued from OBC

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Indian Journal of Tuberculosis

Volume 71 Number S2 2024

Table of Contents

Indian Journal of Tuberculosis 71 (2024) S149–S150

Contents lists available at ScienceDirect

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Editorial

Psychological disorders in tuberculosis and respiratory diseases

The common respiratory illnesses in addition to TBare Asthma, Chronic Bronchitis, Chronic Obstructive Pulmonary Disease (COPD), Emphysema, Lung Cancer, Cystic Fibrosis and Bronchiectasis, Pneumonia and Pleural Effusion. Tobacco smoking can worsen every respiratory illness. If it is never used or stopped use early, according to Centers for Disease Control and Prevention (CDC) can prevent 480,000 deaths.[1] Smoking which negatively impacts person's every organ in the body is relatively more common in patients with psychiatric disorders like depression. Some respiratory diseases have unique ability to cause psychiatric illnesses like COPD, often is associated with generalized anxiety or panic disorder.

In clinical practice it will be prudent to screen patients with tuberculosis and respiratory illnesses for psychiatric disorders. The screening instruments can be used by trained nursing staff in practice settings. Positive screen will warrant further evaluation to confirm diagnosis and development of treatment plan, of these disorders. Effective treatment will improve treatment outcome and quality of life of patients. I will briefly describe the screening instruments for depression, anxiety, and perceived stress. To access source screening tools, please use the provided reference.

Depression prevalence is common in patients with TB. In a 2021 study from Srinagar district in Kashmir researchers noted that prevalence of depression in patients with TB at baseline was 50.5% and after two months of anti-TB treatment this prevalence reduced to 9.4%.[2] This will significantly improve quality of life of the patient and enhance outcome of treatment.

Stigma about TB and emotional disorders is very common in general population, Stigma can rob the patient of hope, self-esteem, respect, social status and interfere with healthy social relationships. These and other stressors are conducive to causing depression. For quick recognition of depression clinicians may use 9 question scale available as Patient Health Questionnaire (PHQ-9).[3] This scale is used as a validated screening tool for depression in Primary or Integrated Care Setting. This is available in Hindi language Version also.

Here, I will share questions related to English version. The questions asked are: "Over the last 2 weeks how often you have been bothered by any of the following problems". The two questions from PHQ-9 will be "Little interest or pleasure in doing things" and" Feeling down, depressed, or hopeless" These two questions comprise PHQ-2.[4] Each question has 4 (four) choices for responses i.e. Not at all (score 0), Several days (score 1), More than half the days (score 2), Nearly every day (score 3). If patient scores, 1–4 points it is Minimal depression, 5–9 Mild Depression, 10–14 Moderate depression, 15–19 Moderately severe depression, 20–27 Severe depression. If question 9 "Thoughts that you would be better off dead or of hurting yourself" is present right away bring this issue to the attention of the physician.PHQ-2 the abbreviated version of PHQ-9. Please secure original source documents for PHQ-2 and PHQ-9 scales for full description of these scales. As described above the first 2 questions of PHQ-9 represent PHQ-2. On this scale of 2 questions scores range from 0 to 6, a score of 3 or greater suggests major depressive disorder. If PHQ-2 is positive for depression patient should be administered full length PHQ-9 scale and a face-to-face interview for evaluation for depression should be conducted to ascertain that patient meets the diagnostic criteria for major depression. After scoring on PHQ-2 or PHQ-9patients on scored questions are asked, "How difficult have these problems made it for you to do your work, take care of things at home, or get along with other people? "The answers may be: Not Difficult at all, Some what Difficult, Very Difficult, Extremely Difficult. Based on scores and difficulty about daily living will strengthen the diagnosis of depression.

Patients with moderate to severe depression especially when they have suicide should be referred psychiatric colleague who is well versed with diagnostic classification system like DSM-5, pharmacological and psychotherapeutic. Interventions. If clinician is comfortable may manage mild cases of depression in their own clinic.

Depressive Disorders in the DSM-5 manual have 7 subcategories. The diagnosis of depression with TB and other respiratory illnesses is documented as "Depressive Disorder due to TB" or other respiratory illness as appropriate. Comprehensive information about psychiatric disorders stated here are beyond the scope of this editorial.

Anxiety Disorder. There are 10 subcategories under anxiety disorder one of these categories is Generalized Anxiety Disorder (GAD).There is 7-item scale (GAD-7)[5] for screening GAD. It is also translated into Hindi version. However, I will share the English version. Please secure that. Each question is asked as "Over the last 2 weeks how have you been bothered by following problems" The first 2 questions are "1. Feeling nervous, anxious on edge "2. Not being able to stop or control worrying." These two questions are abbreviated version of GAD-7 and is GAD-2 version. Each question is scored as 0,1,2,3. This scale also have two question abbreviated version (GAD-2)[6] Scores 0–4 Minimal anxiety, 5–9: Mild Anxiety, 10–14 Moderate Anxiety, score greater than 15 is Severe Anxiety. A score of 8on GDS-7 or score of 3 on GDS-2 more identifies probable cases of generalized anxiety requiring further diagnostic assessment and intervention. After having positive screen, a face-to-face visit using DSM-5 criteria will confirm the diagnosis. The treatment options include nonbenzodiazepine drug like buspirone, sertraline, pregabalin (approved in Europe) for anxiety. Benzodiazepine like lorazepam may be helpful for short term use. If possible, avoid benzodiazepine in patients with COPD due to their respiratory depression effect. Specialized counselling like Cognitive- Behavioral therapy is

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very helpful. For Anxiety Disorders. Depression and anxiety may manifest together.

Perceived stress. In addition to stigma which is a powerful stressor. There are other perceived stresses. 10-point Perceived Stress Scale (PSS).[7] This is also available in Hindi Version. I will use the English version. Each of the 10 questions is based on patient's perception of stress in their life. Each question is rated on (0–4) score (0 = never, 1 = Almost Never, 2+ Sometimes, 3 = Often, 4 = Very Often, with total maximum 40. Because of how questions are structured Questions 4,5,7, and 8 are framed in a way that these have reverse scoring, i.e., 0 = 4, 1 = 3, 2 = 2, 3 = 1 and 4 = 0. Based on scores level of stress is rated as, scores 0–13 Low Stress, 14–26 Moderate stress, and 27–40 High stress. Depression and or anxiety may be related to stress. Stress can be associated with adjustment disorders with anxious and or depressed mood. Addressing patients concerns embedded in perceived stress questions as well as adjustment disorders enhance compliance and better adjustment with family as well as enhance satisfaction with treatment.

In conclusion emotional disorders associated with TB and Respiratory Disorders are not addressed often in a timely manner leading to longer duration of treatment as well as perpetuation of family and social dysfunction.

Declaration of competing interest

None.

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Psychological comorbidities: Impact on respiratory health

ARTICLE INFO

Keywords
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Respiratory disease

ABSTRACT

Respiratory diseases are commonly associated with mental health issues, which add to morbidity and mortality. However, this association has never received sufficient attention. There is an urgent need to sensitize the health care workers for early identification of psychological comorbidities, and their basic management. Mental health should be an integral part of the teaching curriculum. Simple, quick and easy to use screening questionnaires should be used on a routine basis for identifying stigma, psychological distress and poor health related quality of life. Psychiatrist should be a vital part of the multidisciplinary teams. Extensive collaborative research needs to be carried out in this field to devise clear-cut recommendations for day-to-day practise.

1. Introduction

With the advances in medical sciences, a plethora of specialities and sub-specialities have erupted leading to a drift from clinical acumenship to evidence-based medicine in the recent past. It is expected from the physician in contact that he should be able to manage his patient in totality, including comorbidities and multisystem manifestations of the underlying disease, himself, or by close collaboration of his fellow colleagues.

The eyes see what the mind knows. Our minds are tuned to look into the chief complaints and cure the ailments affecting the physical health of the patient, neglecting the mental and social well-being. Thus, health defined as a state of complete physical, mental and social well-being and not merely the absence of a disease or infirmity takes a back seat.[1]

Evaluation of psychological comorbidities and health related quality of life (HRQL) on a routine basis, and addressing the same, if need be, is essential for the physicians dealing with respiratory diseases, if they aim to treat their patients in entirety.

2. Discussion

The physicians who intensely deal with tuberculosis which is highly communicable; pneumonias and chronic respiratory illnesses like obstructive airway diseases, occupational lung diseases, diffuse parenchymal lung diseases and sleep disorders, associated with multi-system involvements; and malignancies, leading to terminality; need to cater to the psychological comorbidity. This is because every disease narrated here is associated with a mental health issue due to infectiousness, chronicity or debility.

Additionally, the alterations in systemic inflammatory processes inherent to such diseases have been found to be linked to behavioural changes, heightened sensitivity to negativities, impairments in social cognitive performance, avoidance, withdrawal, disconnection and rejection; and hence implicated in the etiology of an array of psychiatric disorders. The common ones include anxiety, depression, delirium, personality changes, adjustment disorders, mood disorders, neurocognitive disorders, obsessive compulsive disorders, paranoid disorders, somatoform disorders, and psychosis. Thus, the complex interplay of multiple variables independently contributes to the burden of psychological comorbidities, and if left unattended and uncared for, adds silently to the morbidity and mortality.

Similarly, it has also been documented that psychological comorbidity has developed as an adverse effect of the various pharmacological/non-pharmacological modalities used for treatment of respiratory diseases. Caution needs to be exercised while using some of the antitubercular drugs, antibiotics, anticholinergics, anti-histamines and corticosteroids, for their psychiatric side effects. Long term supplemental oxygen therapy and assisted ventilation techniques in a bed ridden patient add to the mental trauma. The clinicians have always perceived psychological comorbidities to be a significant barrier to compliance to treatment and final outcomes. Challenges have also been thrown repeatedly with respect to polypharmacy, drug -drug interactions, and a general apprehension with the use of psychotropics that they are respiratory depressants. Choosing appropriate medications has always remained a critical task. This clinical scenario needs a very fine tuning between mental health professionals and specialists from other fields. Additionally, the physicians also have to be sensitive to the needs of the caregivers, as they also bear this psychological burden to a certain extent, and may fail to extend support to their patients if mentally unwell.

Recognising this need for mental well-being and HRQL, emphasis on the practise guidelines for different diseases has evolved over the past few decades. However, these issues have still not received sufficient attention, either on a clinical front or in the research settings. In the zeal to treat comorbidities, quest to reach the etiology of the disease, and manage the patients on their own, respiratory medicine specialists

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become overenthusiastic to order various blood investigations and use multiple bedside tools like ECG, echocardiography, radiography, ultrasonography, color doppler etc, until they fail or feel the need to involve another specialist for expert guidance. However, a similar passion to screen for or take the guidance of a psychiatrist to identify the psychosocial comorbidities as a part of routine care is lacking. The training curriculum has to be blamed squarely for failing miserably in sensitizing regarding the importance of mental health issues and their impact on patient care. As a result, the patients suffer from stigma, poor self-esteem, inadequate coping, poor HRQL, psychological distress and psychiatric illnesses, which remain largely unaddressed.

To screen patients for psychological morbidities, simple, quick and easy to use questionnaires are readily available. In a clinical setting, the inertia to administer the questionnaires stems from the lack the basic knowledge, understanding and confidence and as always 'short of time' because of the patient load, thus harbouring a feeling of unnecessary waste of time. The failure in differentiating between screening and diagnostic tools and using them in inappropriate combinations or interchangeably, leads to a setback in research settings. The collaboration between a pulmonologist and a psychiatrist has almost always remained elusive.

The necessity of identification and treatment of psychological comorbidities as a part of patient management has to find a place in the minds of the physicians of first contact. It should be clear that the physicians limit themselves to the use of a screening tool to identify psychological distress, reserving the use of diagnostic tool by a psychiatrist to evaluate and diagnose a psychiatric illness. All psychologically distressed patients necessarily do not bear the diagnosis of a psychiatric illness.[2] In a resource limited setting, the physician and the ancillary staff under his supervision, play a vital role in screening for concomitant psychological distress. It has been seen that the management of milder forms of psychological distress at the level of first contact, through psychosocial support and dedicated counselling sessions is highly effective for treating the underlying physical illness, mental well-being and HRQL, as the patient has reposed faith in his physician. Except for those with full blown psychiatric distress who need immediate referral, early intervention prevents the development of psychiatric illness over a period of time in a good number of patients, thus limiting the concomitant consultation and treatment by the psychiatrist for a very few. The programs and recommendations at the national and global level should immediately focus on the training and sensitization of every ancillary health care worker (HCW) for screening of 'possible' psychological morbidity. The ancillary HCW should be capable of identifying the sub-group of patients which can be managed by him, and promptly refer the other sub-group of 'unmanageable ones' to the treating physician or the psychiatrist as per extent of distress. Lost to referrals should also be gauged before suggesting a patient to visit a psychiatrist.

The management of psychological comorbidities associated with almost every disease in low- and middle-income countries is a challenge due to the paucity of mental health experts.[3] Inspite of this limitation, to the extent possible, the psychiatrist should remain a vital part of the multidisciplinary teams, and a close liaison all through the management pathway should be maintained. In situations where face-to-face contact is not possible, various information, education and communication (IEC) methods should be utilized for this association.

The literature reveals that only a few screening questionnaires have been used for a small number of respiratory diseases in the past to evaluate psychological morbidity and HRQL. Some of them are self-structured and not well tested for reliability, validity and repeatability[4] while most of the standardised ones are non-specific, evaluate only one or the other domain of the spectrum of illness and have not been tested for various respiratory diseases. The examples of the more commonly used ones are Patient Health Questionnaire-9 (PHQ-9), Hospital Anxiety and Depression Scale (HADS), CAT (COPD Assessment Test), Clinical COPD Questionnaire (CCQ), St. George's Respiratory Questionnaire (SGRQ) and World Health Organization Quality of Life Instrument (WHO-QOL) and lesser used like General Health Questionnaire (GHQ), Patient Distress Thermometer (PDT), Depression, Anxiety and Stress Scale - 21 items (DASS-21), Coping Strategy Check-List (CSCL), Rotterdam Symptom Checklist (RSCL), COPD and Asthma Sleep Impact Scale (CASIS), COPD and Asthma Fatigue Scale (CAFS), Functional Performance Inventory-Short Form (FPI-SF), Van Rie TB stigma scale (VTSS), 28 item stigma related scale, Rosenberg's self-esteem scale and Stigma related social problem scale.[5–10] Correlation of various questionnaires with the trajectory of the disease status as well as amongst each other for their superiority has rarely been studied.

There is an urgent need of research to develop screening questionnaires, evaluating all the domains of mental consequences of a particular disease, so that they can be used as a routine bedside tool. Until then, the currently available standardised and validated screening tools for different illnesses should be applied, alone or in combination, in our day-to-day practise, to decipher all the domains of mental suffering in our patients with respiratory diseases. Psychological distress is assumed to vary greatly because of socio-economic and cultural differences, epidemiological patterns and severity of underlying respiratory disease. Therefore, to provide real insights and unearth the true burden, generation of robust authentic data from different geographical regions is the need of the hour.

All HCW's involved in pulmonary care should work in unison to elucidate the complete range of mental health issues in patients with respiratory diseases and address them as a part of routine treatment protocol. Day to day experiences and good practises in this context be consolidated, summarized and presented to the policy makers to usher 'change for the better' at the global level.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Stigma in Tuberculosis

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Tuberculosis (TB) is a common cause of stigma. Stigma is a powerful negative psychosocial state which robs patient of their dignity, self-respect, positive self-image, and respectable position in the community. This can undermine hope. The patient may experience shame and guilt about having the disease due to their actions or patient may attribute this disease to a curse from a higher power e.g., God. For fear of transmitting the disease to family, friends or community at large may have patient maintain a secret about disease as well as other factors may result in self-discrimination. Patients are afraid that by disclosure of illness they may be subjected ridicule or gossips in community. Moreover, this secret may also result in anxiety, depression, and stress. Having the disease and mental illness further magnifies stigma. Occasionally the health care workers may also perpetrate stigma on patients. Stigma unfortunately affect disproportionately at a higher rate to individuals from lower socio-economic status who are often discriminated thereby enhancing the risk of stigma. Due to self-discrimination and stigma individual may not seek medical care or may be noncompliant with recommended treatment. Stigma promotes discrimination from society. Due to lack of knowledge about the disease some members in society may ridicule, patients or avoid interacting with them at work or social gathering or may communicate to patient other nonverbal negative behaviors In India and other countries diagnosis of TB is associated with strong stigma woven into societal and cultural fabric. To mitigate or better eliminate stigma will requires concerted plan and efforts. No stigma will be win-win situation for the patients and their families Here are suggestions to address stigma.

- TB can afflict anyone in the society, individuals who are fathers, mothers, or professionals. A strong public service educational programs about TB education about the cause and its treatability can help reduce stigma. This education can be provided using multimedia portals (radio, TV, podcasts), conveying that TB is an illness which is caused by infection and is treated successfully. Also reinforcing that this disease is not caused by unnatural forces like curse.
- Education about prevention of spread of the disease to others and precautions about contracting the disease will be very valuable.
- Help dispel false believes about TB at personal level by the staff involved in care of TB patients.
- Have celebrities and leaders convey message about treatability of disease and encourage patients to seek help.
- Have willing patients share their personal recovery story and successful outcome of treatment.
- Have hopeful messages about treatability of the illness displayed in public areas like in movie theaters prior to trailer of the movie theaters, requesting producers and distributors for pro bono public service.
- Lobby parliamentary leaders by sharing with them the negative impact on societal productivity and national GDP due to illness.
- Solicit help from national and international philanthropic organization to support education and treatment messages.

Declaration of competing interest

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Screening and management of depression among patients on TB treatment in Papumpare district, Arunachal Pradesh, India

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ABSTRACT

The TB-depression syndemic is a complex health condition. This study demonstrates a collaborative model to screen and manage depression among TB patients and understand the enablers and challenges from the healthcare workers perspective regarding its implementation. The PHQ-9 questionnaire was used to screen for depression and in-depth interviews among five healthcare workers were taken to explore its feasibility. Eight healthcare workers were trained for the screening that was carried out in two tuberculosis units of Papumpare district over a period of three months. Of 46 eligible patients screened, 43 (93.4%) screened positive for depression. Fifteen patients with moderate, moderately severe and severe depression were referred, of which five (33.3%) visited the psychiatric OPD. Two patients were diagnosed with clinical depression by a psychiatrist and started on treatment. The reasons for smaller number of patients being screened were time constraints, lack of manpower, lackadaisical attitude towards TB disease and patients' parents or guardians coming to take medicines. Enablers and challenges were explored under the heads of training, screening tool and PHQ-9 questionnaire, psychiatrist referral and counselling. This study demonstrates implementation of a feasible model for screening of depression among TB patients using the PHQ-9 questionnaire within programmatic settings using available resources.

1. Introduction

The burden and deaths due to tuberculosis (TB) are a major concern around the globe. Over 10.6 million people (95% confidence interval (CI): 9.9–11 million) fell ill with TB worldwide in 2021.[1] The TB incidence globally rose by 3.6% between 2020 and 2021.[1] Regardless of the efforts being made for TB promotion and preventive interventions, it remains a leading cause of mortality worldwide despite being treatable and curable.[2] Prevalence of all forms of TB in all ages was found to be 312 per 100,000 population as per the national prevalence survey 2019–2021.[3]

In India, the prevalence of any mental health condition is 10.6% (point prevalence) and 13.7% (lifetime prevalence).[4] One in every 20 Indians were reported to suffer from depression in 2015–16.[5] Mental disorders are among the leading cause of the global health-related burden, with depression and anxiety being the most common.[6] Tuberculosis disease is linked to mental health in a complex way[4] Treatment for TB is long with physical, psychological and social stress for patients and caregivers, which may exacerbate mental health disorders. Studies have reported that mental health disorders are more common among people with TB than the general population.[7] The prevalence of depression in TB patients has been reported to be three to six times

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higher than in healthy controls.[7,8] Tuberculosis is still associated with stigma and misconceptions, and a mere diagnosis of TB can bring about psychological trauma.[9] Reports show that tuberculosis and mental illness share common risk factors leading to frequent comorbidity. [10]

However, with timely screening and intervention, TB patients with mental health comorbidities can have similar outcomes to those without such comorbidities.[11] Currently, while there are guidelines on mental health screening, the implementation is not adequate. Thus, there is a felt need to provide comprehensive TB management which includes screening for depression and providing a consultative–liaison for psychiatric care. Assessing mental health and, thereby depression among TB patients require a systematic approach as well as access to referral services for further management. In this context, all TB cases should be screened for depression, and all identified cases be referred to a psychiatric expert for diagnosis and management. Screening activities with available human resources through adequate training and supervision seems feasible. Thus, within the programmatic settings, we aim to demonstrate a collaborative care model for screening and management of depression among TB patients on treatment at public facilities in Papumpare district, Arunachal Pradesh, and document the challenges and barriers for implementation of this model of care.

2. Materials and methods

2.1. Study design

This study used a mixed-method approach within the programmatic settings at public health facilities in Arunachal Pradesh, India.

2.2. Study site and settings

The study was conducted in Papumpare district, Arunachal Pradesh, a tribal state located in northeastern India sharing international borders with Bhutan, Myanmar and China and national borders with Assam and Nagaland. The site selection was purposive as it contributes to 50% of all tuberculosis notifications of the state (51.5% in 2022 and 52.2% in 2021, Nikshay) and the availability of psychiatric OPD. The psychiatry OPD was located at TRIHMS Medical college, Naharlagun. While one TB Unit was co-located in the same building as the medical college, the other 14 km away from the designated psychiatry OPD. The study was conducted during the period of May to July 2023 (Table 1).

3. Study population

The study population included all consenting TB patients, newly diagnosed or on treatment, above the age of 18 years and coming to the health facility for treatment from May–July 2023.

For the qualitative phase, the staff in the health settings who were involved in the screening and referral of patients were interviewed. The providers included Senior Treatment Supervisor (STS), Senior TB Lab Supervisor (STLS), TB Health Visitor (TBHV), PMDT and TB-HIV Coordinator of the health facility (DOTS center and designated Microscopy center). A purposive sampling method was used so that all the cadres of staff are represented. Five (5) in-depth interviews (IDIs) were taken for feedback on the challenges encountered while implementing the program.

4. Interventions

The intervention was implemented in the following steps (Fig. 1)

4.1. Planning and strategy

Administrative approval was taken from the State TB Officer (STO) to conduct the study and use of patient records for obtaining socio-demographic data and a planning meeting was done with all the stakeholders. The STO, District Tuberculosis officer (DTO) and Medical Officer-Tuberculosis Unit (MO-TU) participated. The meeting and planning mainly focused on feasibility, training and nominations of the human resource (HR) for the study.

Table 1
Socio-demographic profile of patients on TB treatment at public health facilities in Papumpare district, Arunachal Pradesh, India -May-July 2023 (N = 46).

Variable		Patients on TB treatment		Patients screened and referred as having depression	
		Number	(%)	Number	(%)
Health facility					
	TRIHMS	22	47.83	20	46.51
	ITAFORT	24	52.17	23	53.49
Age Mean (SD) (years)		**27 (10.66)**		**26 (8.41)**	
Age group					
	<30 years	32	69.57	30	69.76
	30–50 years	13	28.26	13	30.24
	>50 years	01	2.17	00	–
Gender					
	Male	19	41.30	19	44.19
	Female	27	58.70	24	55.81
Education					
	Illiterate	5	10.87	4	9.30
	Primary	2	4.35	2	4.65
	Secondary	7	15.21	7	16.27
	Higher secondary	14	30.43	13	30.23
	Graduate	15	32.61	15	34.88
	Post graduate and above	3	6.52	2	4.65
Occupation	Business	3	6.52	3	6.97
	Daily Wagers	3	6.52	3	6.97
	Farmer	1	2.17	–	–
	Govt. Job	7	15.21	7	16.27
	Others	7	15.21	6	13.95
	Student	25	54.34	15	55.81
OSSS-3 score#	Poor social support	12	26.09	12	27.91
	Moderate social support	21	45.65	20	46.51
	Strong social support	13	28.26	11	25.58

N = number, % = percentage, #OSLO Score (OSSS-3) for Social Support, Depression = moderate and severe depression.

4.2. Training and capacity building of the health personnel

Training session were conducted for the staff of Designated Microscopy Centers (DMCs) and Directly Observed Treatment, Short course (DOTS) centers. The participants included Senior treatment supervisor (STS), senior TB lab supervisor (STLS), TB health visitor (TBHV), Program Management of Drug Resistant TB (PMDT) and TB-HIV coordinator and staff nurse of the respective health facility (DOTS center and DMCs)

The training covered the basics of TB and mental health in TB, study procedures including how to take consent , maintaining confidentiality, administration of the questionnaire, PHQ-9 administration and interpretation, and referrals and follow-ups.

4.3. Cascade of management for screening of depression TB patients (Fig. 2)

The TB patients coming to the public health facilities were assessed for eligibility criteria. Informed consent was obtained by the trained staff for those eligible and those who refused to give consent were excluded. The socio-demographic data were captured using a structured questionnaire and the PHQ-9 tool was used to assess the depression status.

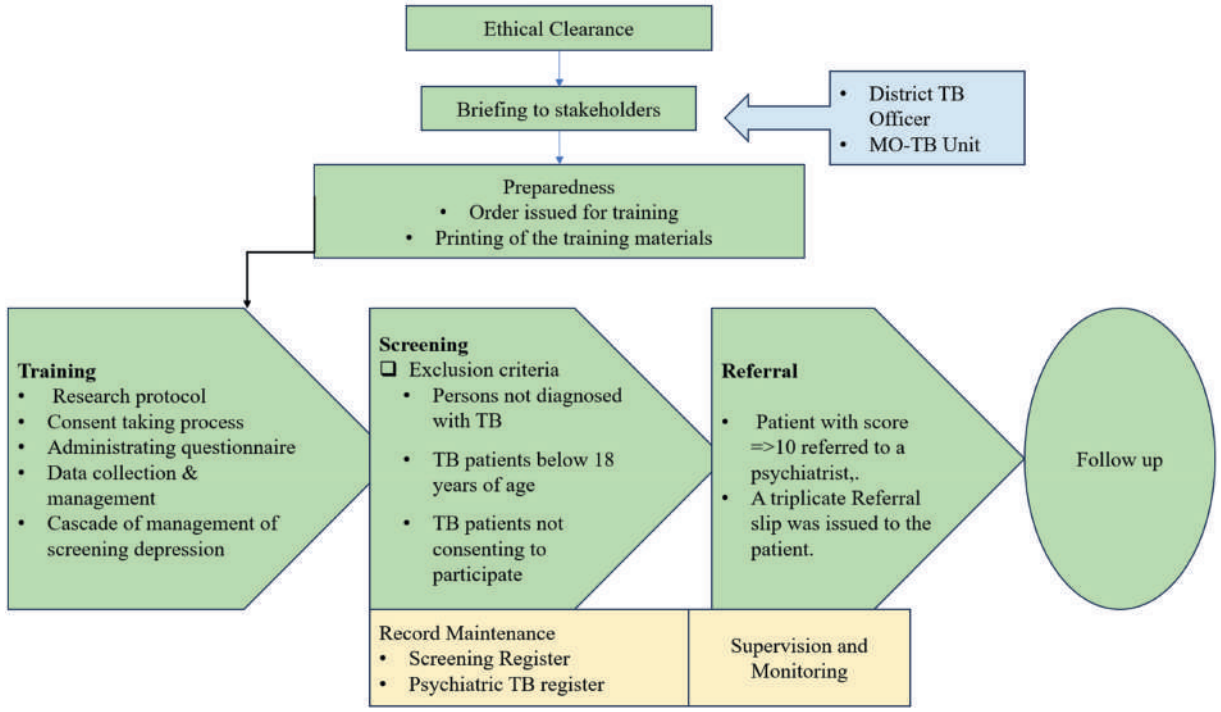

Fig. 1. Process flowchart for the screening and management of depression among TB patients enrolled in Papumpure district (May–July 2023).

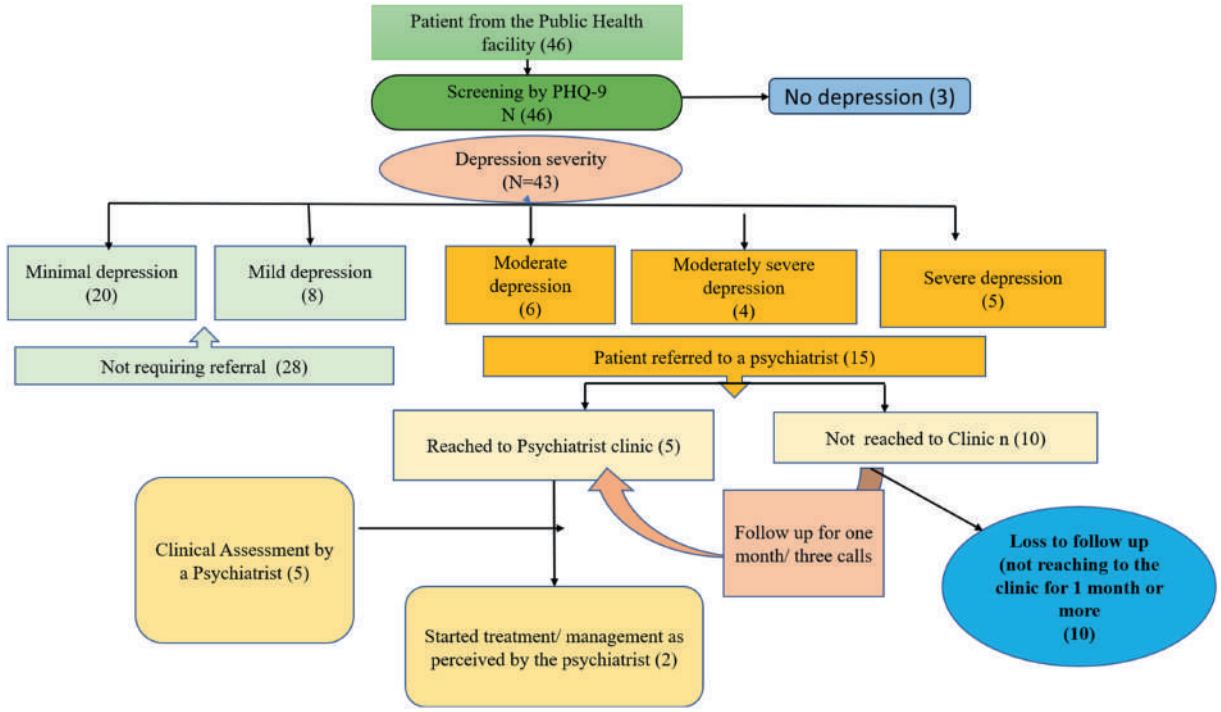

Fig. 2. Cascade of management of TB Patients enrolled in Papampure district (May–July 2023) and screened for depression.

The PHQ-9 scoring tool was used for determining referral to designated psychiatry OPD. A score of 10 and above in PHQ-9 was referred to a designated clinical psychiatrist for further evaluation.[12,13]

4.3.1. Data collection

TB patients coming to the public health set-up (DOTS centers and DMCs) were screened and their records were maintained in the TB register. The interviewer put "screened" in the remarks column in the register to ensure that there were no duplicate screenings.

For referral to a psychiatrist, a referral slip was issued to the patient, which was in triplicate. Two slips were issued to the patient and one was kept at the health facility. Once the patient reached the psychiatrist, the patient produced the referral slip, where one slip was kept by the psychiatrist for records. The psychiatrist maintained a register of TB patients who were referred after screening for depression using PHQ-9. The register had the patient's record and psychiatric intervention.

Participants carrying the referral slip were sent to the OPD room specifically set up for psychiatric consultation.

To ascertain the quality of data collection and maintenance of records, monitoring was done on a fortnightly basis. Monitoring was done by the principal investigator and officials (DTO and MO-TU) in the respective health centers.

4.4. Data variables, sources of data and data collection

4.4.1. Quantitative component

Data was extracted from the patient cards, and PHQ-9 was administered to screen for depression. Referral slips in triplicate were used to follow up the patient cascade.

4.4.2. Qualitative component

One-to-one interviews were conducted using a semi-structured interview guide. Five in-depth interviews of the health care providers were taken, and each interview lasted for about 15–20 min. All the interviews were scheduled at a place and time convenient to the participants. Interviews were conducted by the principal investigator and is trained in qualitative research. The interviews were conducted after obtaining consent from the participants.

4.5. Data entry and analysis

The data was collected in hardcopies and entered in the EpiData Manager entry v4.6.0.6 software. Double data entry was done, the data entry records were verified and discrepancies, if any, were resolved. The final record file was used for analysis using Epi Info v7.2.5.0.

4.5.1. Quantitative data

The quantitative data variables like age and family income were reported in mean (SD) OR median (IQR). The PHQ-9[12,13] and OSSO-3 score for social support [14] was reported as Median and IQR.

Derived variables: The PHQ-9 and OSSO-3 scales were converted to the following categorical variables for categorization of depression and social support or no social support respectively.

PHQ-9 has nine items, each of which is scored 0 to 3, providing a 0 to 27 severity score. As per the sum of scores, interpretations of PHQ-9 score were classified as mild (PHQ-9 score: 5–9), moderate (10-14), moderately severe (15–19) and severe (20–27).

The Oslo Social Support Scale (OSSS-3) categorizes social support into poor (score of 3–8), moderate (score of 9–11) and strong (score of 12–14)

Qualitative variables like gender, education and age group were reported as percentage and proportions.

4.5.2. Qualitative data analysis

Transcripts were made the same day based on the voice recordings of the interview. Manual descriptive content analysis was done by the PI and another co-investigator (KS) to identify themes under the broad topics: challenges and suggested solutions. A third investigator (CL) reviewed the analysis, and any disagreements between researchers was resolved by discussion. The final tables arising after qualitative data analysis was shared with all investigators for their feedback and approval.

4.6. Ethical consideration

The Ethics clearance was sought from the Ethics Advisory Group of the International Union Against Tuberculosis and Lung Disease, Paris, France and the Institutional Ethics Committee of Tomo Riba Institute of Medical Science, Naharlagun, Arunachal Pradesh.

All the participants in the study gave written informed consent to participate.

4.7. Results

During the study period, 339 TB patients were reported from Papumpare district. From this cohort, 294 patients were eligible for the study based on the inclusion criteria. Of the eligible patients (n = 294), 46 (15.6%) were screened for depression. The mean (SD) age was 27 (10.7) years, and almost two-thirds were below 30 years of age (32,69.8%). More than half of them were female (27,55.8%). Among these (n = 43), 9.3% (n = 4) were illiterate, and they had good to moderate social support (21,46.6%).

The reasons for a proportionately smaller number of patients being screened for the study, as per the qualitative interviews, were time constraints, lack of manpower, lackadaisical attitude towards TB disease and patients' parents or guardians coming to take medicines.

Out of the total patients screened (n = 46), 43 completed the PHQ-9 questionnaire. Of these, 15 (34.9%) had moderate, moderately severe and severe depression, requiring psychiatric referral. Five out of the 15 (33.3%) referred cases reached the psychiatric outpatient services. Two out of these five were started on treatment after evaluation. Ten were lost to follow-up (Fig. 2). The DMC co-located with psychiatric OPD recorded 33% loss to follow up cases whereas DMC which was located 13 km away recorded 90%.

Based on the qualitative findings, the reasons for not reaching referral centers maybe attributed to lack of proper counselling, which, the healthcare workers believed that, with proper counselling, many patients might seek psychiatric consultations. Some of the patients refused and were not serious about the referral.

4.8. Training

In terms of training, the staff mentioned issues of manpower, time as well as giving training to those who were in direct contact of patients, such as the DOT providers.

> ***"As per*** (the) ***set up, my DOTs provider having direct contact with the patient … they need to understand it*** (the training) ***more. From my side, I guide and tell them to interact with the patient and do the needful and provided them all the forms/documents for the OR." (STS)***

Overall, they seemed satisfied with the training, though one of them mentioned it was time consuming.

4.9. The screening tools

All of the interviewed health providers mentioned that the tool was lengthy. One of the challenges which they mentioned was staff having **'writing problems',** meaning it was difficult for them to fill the tool. They mentioned that the challenge here was patient losing interest while filling the consent form.

> "The documentation on screening tool is given from annexure 1 to annexure 4, it was bit lengthy, while entering the details, there is bit time taken … … … …" (STS)

One of them said that the patients gave casual answers to the questions, while for a few the questions were confusing.

While the study tool was perceived to be lengthy, the study staff did not face difficulty in administering the PHQ-9 questionnaire.

> " …. the annexure 1 part are already covered in the NTEP forms, so no need of asking much. Apart from education status, all (details) are there already, so we start with PHQ-9". (TBHV)

4.10. PHQ-9 questionnaire for depression

The enablers for the PHQ-9 screening tool were that it was easy to understand for the health care workers, however, would be difficult for

patients to fill it as a self-directed questionnaire. One of them mentioned it was "***doable".***

However, one of the providers mentioned that it was not easily acceptable to the patients; while another said that the patients feared giving answers regarding their mental health.

4.11. Study participation and psychiatric referral issues

There were varied views regarding the patients giving consent for participation. The challenge herein was that few lost interests while being explained about the consent forms, while some gave consent without hesitation; some of them felt uneasy with the process, while a couple of them did not have time.

> "When consent is taken, many of the patients acts as if they are ignoring the consent process." (STS)

> "Some patients feel uneasy, some feel easy and other seems like ignoring. Got three types of patients, but nobody refused to give consent" (STS)

> " …. patients who can understand hear very attentively, but some say, they don't have time or don't want to participate, they fear of further referral and don't want it, so they don't participate." (TBHV)

Another reason was, that in case of many patients, their parents (school going children) or guardians came to collect the medicines.

> "No, if we ask them, they give consent. But student patient doesn't come, their guardian come to take the medicine. First time the patient comes, but subsequently their parents/ guardians come to take the medicine." (STLS)

When it came to referring patients who were screened as having moderate, moderately severe or severe depression, the response of providers was that some went, some refused to go as they did not feel the need or necessity to do so. One of them mentioned that though patients were referred, whether they went the same day or were lost to follow up was not known, this being one of the challenges.

> "… okay, I will go later, the patient says. We tell them where to go. Example, there was a patient, probably a maid servant, after counselling we told her to visit the psychiatrist at TRIHMS, the reaction from her was, let it be, we will start the medicine first. We told them to visit, but probably she never went." (PMDT Co-Ordinator)

However, one of the health providers mentioned that the patients may be in real need of referral too.

> "One patient got extremely happy, when heard about referral to psychiatry. The patient was seeking for such referrals as the patient thought he was having some psychiatric issues. Others did not gave bad reactions and said they will visit the Psychiatric OPD."(TBHV)

A positive suggestions that came up was that the psychiatrist referral may be mentioned in the NTEP Program card itself; which already has other referral options in place.

4.12. Future implementation/integration of the PHQ9 questionnaire in the NTEP

All the respondents agreed that the screening tool could be implemented under NTEP in future. However, they suggested proper training, a separate counter for counselling purpose, shortened format of the questionnaire, counselling training to existing staff – if they were to 'multi-task', having a separate dedicated counselor.

One of them mentioned concern regarding the additional burden it would add on the existing staff.

> "..except for increase in workload. In the starting days, we use to write down patient's name, give them medicine and let them go. Now we have to maintain many records. Send the patient for HIV (testing), take weight 2–3 times and do that." (TBHV)

It was suggested that PHQ-9 could be taken up as a self-administered questionnaire for those patients who could understand it.

5. Discussion

The study was carried out within the routine programmatic setting in Papumpare district of Arunachal Pradesh to demonstrate the feasibility of a model of care for depression among tuberculosis patients. It is documented that there are chances of mental health derangement among TB patients due to delayed diagnosis, longer duration of treatment and adverse events, adding to the out-of-pocket expenditure.[15] There is no integrated programmatic and referral service between the National Tuberculosis Elimination programme (NTEP) and National Mental Health Programme (NMHP) at present.

Arunachal Pradesh, the setting where this study is done, does not have any documented reports on the prevalence of depression among the population. However, clinical hearsay does show that there could be a high prevalence of depression among patients on TB care. Therefore, this study is an attempt to demonstrate the feasibility model within the programmatic setting through screening and a coordinated referral mechanism for depression among TB patients.

The process of implementation for this study was carried out in stages beginning with a planned training and data management, referral of patients screened for depression, diagnosis of clinical depression and its management. This study was carried out under the existing programmatic NTEP setup involving the current human resources. Responses from the qualitative interviews also mentioned the ease of carrying out screening among the TB patients, provided a few of the challenges like having dedicated counselors could be overcome.

The screening results showed 43 out of 46 patients as some degree/ form of depression. Though a small sample, the high proportion of depression reported shows the public health relevance of having a screening program for depression in TB patients; which otherwise may go unnoticed. Depression may be affecting half of the individuals with tuberculosis. [16] In a study conducted in a similar setting in East district, Sikkim, the prevalence of depression among patients with pulmonary TB receiving DOTs was found to be 56.3%.[17] Not many published studies have tried to look into the mental health burden in the State, hence, this study entails the importance of regular screening and referral of TB patients to look into the prevalence of depression and facilitate further management.

Of the patients screened, more than one-thirds required referral to the psychiatrist for confirmation of depression and further management. However, of the 18 patients, only five (5) reached the referral center. The screened patients refused going for referral due to perceived notion of not having mental health problems. There were a couple of them who had felt need of being screened for mental health issues. A high percentage of loss to follow up in the study entails the need for a dedicated counselling program along with regular follow up of screened patients; which also came up as one of the challenges and suggested solutions during the qualitative interviews.

Two out of five patients reaching the referral center were diagnosed with clinical depression and required treatment. Thus, the tool used in this study can be used for screening purpose in the routine program. Validation of the same can be done on a larger cohort. The perspective of health care workers on care model of depression screening was widely evaluated by five in-depth interviews. There were four key findings while implementing the model.

Firstly, we found it was feasible and effective to use PHQ-9 as a screening tool to assess depression in the TB patients. The healthcare workers found it to be "doable". In the routine programmatic setting, time duration required for screening would be reduced as compared to the study time. Based on the interviews, addition of PHQ-9 would help,

since rest of the data is already collected in the NTEP. Patients screened in the study were less as the human resource within the setup was limited to include all patients on a day-to-day basis. Further to this, screening at the time of enrolment for TB treatment may help in covering all the patients.

Second, the referral linkage to a Psychiatric OPD can be established with proper coordination. In normal OPD settings, the Psychiatrists attends to all patients, a dedicated referral OPD/setup in convergence with the National Mental Health Programme would be a better policy. The study findings suggested that, many patients not visiting the referral center were due to lack of motivation which could be due to the inconvenience in travelling due to diverse healthcare settings (TB Units to Psychiatric OPD). Besides, almost two-thirds of the patients were students or daily wagers, making financial constraint a probable reason. The healthcare workers believed that with proper counselling many patients may seek psychiatric consultations.

Third, there was a high percentage of loss to follow up cases. Ten out of 15 referred cases never visited the designated psychiatric OPD. Based on the qualitative study finding, if the referral cases are counselled by a trained counselor, the percentage of visits may increase. A stronger patient-provider interaction needs to be established, as in this study, either parents or guardians came to collect the medications instead of the patients. Also, Patients may not be counselled properly or the untrained counselors may not counsel the way it should be. Therefore, counselling TB patients with depression is a desirable intervention as opined by the healthcare workers, and is worth exploring.

Fourth, there was a mixed response from patients on being referred to a psychiatric OPD. We found that, the majority of patients had a casual outlook towards mental health issues and did not feel it necessary to visit a psychiatric OPD. For few of the patients, there is no clear explanation to the reluctancy. However, they were surprised and shocked regarding their depression status. Reasons for this mixed response is unclear, it may be either due to lack of awareness on mental health, difficulty in accepting their 'depressed' status, stigma related to Tuberculosis or other factors. Not reaching the health center for further evaluation or not continuing with medications could be attributed to these factors, however, this was not captured in details herein. In addition to these issues physical distance to the center for mental health, inconvenience in reaching the place in terms of terrain, time and monetary constraints can be other reasons for not going to the referred place. This may need further validation in future studies.

The strength of this study was its involvement of healthcare workers and implementation within the routine programmatic setting. Also, apart from screening of the patients, in-depth interviews were carried out for the healthcare workers perspective. However, the study had certain limitations. Within the study duration, the number of patients enrolled in the study was less. There was no systematic way to address the loss to follow up cases. In usual scenarios, the TB and mental health care can be provided in the same setup. This may reduce the drop out significantly. Nonetheless, there was no structured set-up for psychiatric OPD. The psychiatric OPD at the medical college was used as referral unit. The DMC co-located with psychiatric OPD recorded 33% Loss to follow up cases whereas DMC which was located 13 km away recorded 90%. The high rate of loss to follow up cases probably attributed to the physical distance, inconvenience in travelling and financial constraint.

As a way forward, the study can be continued on a larger sample size and compare the outcomes and also identify and measure the factors affecting depression.

6. Conclusion

This study demonstrated a feasible and practical model for screening of depression among the TB patients using the PHQ-9 questionnaire. A high proportion of patients were screened to have some form of depression, with a high loss to follow up rate while referral. There is a need to collaborate Mental health programme with TB programme for a smooth referral of patients with depression. Also, the study highlights the need for dedicated counselors, and soft skill training for the TB programme staff to counsel the TB patients screened for depression. Further studies need to be conducted to understand the high loss to follow up rate and strengthen the referral mechanism.

Author contributions

Conceptualization: Apang O, Shringarpure KS, Laxmeshwar C,; Methodology : Apang O, Shringarpure KS, Laxmeshwar C; Data Analysis : Apang O, Shringarpure KS, Laxmeshwar C, Nuken ; Data Analysis: Apang O, Shringarpure KS, Laxmeshwar C ; Manuscript preparation: Apang O, Shringarpure KS, Laxmeshwar C, Nuken,; Manuscript editing; Apang O, Shringarpure KS, Laxmeshwar C, Nuken, Loyi T ; Manuscript review: Apang O, Shringarpure KS, Laxmeshwar C, Nuken, A Yubey M, Nyori M, Loyi T , Tongshi PD, Tala P ; Corresponding author : Shringarpure KS, Laxmeshwar C. All authors have read and agreed to the publish version of the manuscript.

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Conflicts of interest

The authors declare no conflict of interest.

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Psychological disorders in tuberculosis: A narrative review

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ABSTRACT

India is one of the highest tuberculosis burden countries in the world. Tuberculosis has an impact on physical, mental and social well being of patients as well as caregivers. The physical disabilities resulting from tuberculosis have been extensively researched, but there is a gap in knowledge about its psychological impact. Available studies have shown a very high burden of psychological disorders in patients with tuberculosis. The national tuberculosis elimination program has made huge strides in treatment success, but there are lacunae in recognition and management of the associated psychological disorders. This narrative review aims to understand the burden and causes of psychological disorders in tuberculosis, as well as strategies for early identification by treating physician and treatment for the same.

1. Introduction

"Fear is every doctor's enemy and every patient's bedfellow"[1]

According to the World Health Organization (WHO) Global tuberculosis (TB) report, there are 2.82 lakhs new cases of TB each year in India.[2] The incidence of multi-drug resistant/rifampicin resistant (MDR/RR) TB is 48,000 per year.[2] India is one of the highest TB burden countries in the world, accounting for 28% share of the global burden.[3]

The association between psychological disorders and TB was reported as early as 1935 by Breur, who mentioned "psychic factors" as a cause for TB and by Knapp who wrote "the diagnosis of tuberculosis brings with it terrific psychic shock and mental trauma".[4,5] Various studies have reported high prevalence of psychological disorders in TB, with Doherty et al. stating numbers as high as 70%.[6] Both TB and psychological disorders have some common risk factors such as poverty, homelessness, and alcohol abuse. Despite the high burden of psychological disorders in TB, awareness, evaluation and management of psychological disorders in patients undergoing treatment for TB is lacking.

Interestingly, cognitive behavior therapy (CBT)-the cornerstone of modern psychotherapy has been developed on the lines of group therapy, which was first used for patients with TB.[7] Joseph Pratt, a physician used to hold weekly group counseling with home visits for patients with TB who could not afford sanatorium treatment. The success of group therapy laid the foundation of CBT.[7] It is indeed ironical that this modality of management of psychological disorders is relatively neglected for that very same disease, where its origin lays.

This is a narrative review of psychological disorders in TB, including burden of the problem, understanding the causes and ways to incorporate psychological disorder assessment and treatment into comprehensive management of TB in India.

1.1. Burden of psychological disorders in TB

Systematic reviews have estimated that almost one in two patients of TB develop depression.[8,9] Alene et al. conducted an exhaustive systematic review and meta analysis for estimating TB related disability across 49 countries and including more than 2 lakh patients.[10] They reported that mental health disorders were the most common disability associated with TB, even more than respiratory impairment.[10] Also, they found out that the highest prevalence of mental health disorders (almost 50%) was in low income countries.[10]

1.2. Psychological disorders in TB

The major psychological disorders encountered in patients with TB are depression, anxiety, mood disorders, post traumatic stress disorder (PTSD) and psychosis.[10] Depression and anxiety are the two most common psychological issues faced by patients with TB. There is considerable overlap between symptoms of TB and depression, namely; loss of appetite, weight loss, fatigue and poor sleep. This leads to frequent delays or missed diagnosis of psychological disorders.

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1.3. Causes of psychological disorders in TB

As soon as a diagnosis of TB is established, patients have an overwhelming feeling of shock and shame. This is followed by anxiety related to fear of serious illness, death and infecting near and dear ones. Together with isolation, loss of jobs and stigma, patients may develop loss of self esteem and self worth.[11]

A) Stigma and discrimination:

The stigma associated with TB makes patient feel isolated and lonely, both at the workplace and home. Dhingra et al. found significant level of stigma among patients with TB at a study conducted at Delhi (N = 1977).[12] They reported that 60% of patients do not reveal their diagnosis to friends and neighbors. Also, stigma was more common among middle class and female patients.[12] This feeling of discrimination hampers the personal, sexual, social and professional aspects of patient's life.

B) Common risk factors:

Both TB and psychological disorders share some common risk factors, such as, poverty, poor education, homelessness, unemployment, alcohol, tobacco and substance abuse, HIV infection and lack of social support. Sweetland et al. have used the term "TB-depression syndemic" for the complex, bidirectional synergy between TB and mental health.[13] According to them, it is important to address this syndemic to end the TB epidemic. Hayward et al. conducted a systematic review of cohort studies done over 50 years, including more than 6 lakh people across various countries.[14] They reported that mental health is an independent risk factor for TB.[14]

C) HIV-TB co-infection:

Previous studies have shown association between HIV infection and depression.[15] Multiple factors are responsible for this association, namely, neurotropism of the virus, intra-cranial infections and adverse effects of antiretroviral therapy (ART).[15] There is bi-directional link between HIV and depression. Deribew et al. reported that HIV-TB co-infected patients were 1.7 times more likely to experience common mental disorders than the non-co-infected patients in Ethiopia.[16]

D) Alcohol abuse:

Alcohol abuse has been established as a risk factor for TB and psychological disorders, individually as well as together. The five most important risk factors contributing to increasing TB burden in India are: undernourishment, alcohol use, smoking, diabetes mellitus (DM), and human immune-deficiency virus (HIV).[2] Around 2.5 lakh prevalent cases of TB in the country are attributable to alcohol use.[2] TB cases attributable to alcohol use are far more than those due to DM and HIV combined.[2] Poverty, alcohol abuse, TB, HIV and psychological disorders are part of a vicious cycle, with each component synergistically contributing to disease.

E) Drug induced:

Certain drugs used for the treatment of TB are associated with psychiatric adverse drug reactions (ADR). These include isoniazid, cycloserine, ethambutol, ethionamide, and fluoroquinolones.[17] Cycloserine has been associated with psychotic depression and suicidal tendency. It is important to differentiate and identify drug induced psychological disorder because replacement with other anti-tuberculosis treatment (ATT) has been shown to reverse psychiatric symptoms.

1.4. How psychological disorders affect management of TB

As early as 1948, Tollen et al. recognized psychological implications of TB as a cause for interrupted treatment and premature discharge from hospitals.[18] Mental disorders are an important cause of default and loss to follow up among TB patients. This leads to increase in infectivity and increased burden of drug resistance, thus being a public health problem. So, management of psychological disorders in TB patients is important to ensure compliance to ATT. In a study conducted in India, Janmeja et al. reported that psychotherapy improves adherence to TB treatment.[19] Patients take better self care, better diet and exercise and have improved quality of life.

1.5. Psychological disorders in MDR-TB

All the psychological effects of TB diagnosis are magnified manifold in patients with MDR-TB. The level of stigma, fear and hopelessness associated with disease is more severe in MDR-TB patients.[20] Patients have a crippling fear of MDR-TB treatment being their last option.[20] In comparison to drug sensitive TB, MDR-TB treatment is longer and fraught with more complications. Almost all the drugs used for MDR-TB therapy are associated with psychological adverse effects. Alene et al. (2018) conducted a systematic review and meta-analysis of 40 studies across 20 countries for estimation of prevalence of mental health disorders in MDR-TB patients.[21] They reported that MDR-TB patients have significantly higher prevalence of mental health disorders (depression, anxiety and psychosis) and significantly lower quality of life as compared to drug sensitive TB.[21]

1.6. Awareness about psychological disorders in TB among physicians

A qualitative study was conducted across India, Pakistan and Bangladesh by Todowede et al. (2023) to identify barriers in providing mental health care to patients with TB.[22] Through interviews with clinicians and health care workers (HCW), they reported that clinicians are not confident about their knowledge to identify and treat depression in patients with TB.[22] Also, they attribute certain symptoms of depression such as loss of appetite, weight and lethargy to TB. From the patients' point of view, they found that patients are not comfortable enough with their HCW (especially from opposite gender) and don't trust them with their mental health concerns due to lack of respect from them.[22] This study highlights that awareness and compassion, both are lacking among clinicians and HCW caring for patients with TB.

1.7. Future directions

Sweetland et al. (2019) conducted a qualitative study to assess receptivity of integration of TB-mental health care services among National TB program directors.[23]They found that among 26 countries, routine psychological screening of TB patients was done in only two countries, and only five countries had guidelines for management of co-existence of TB and mental health disorders. The major barriers to mental health care integration into TB control programs were limited capacity, limited resources, inability to identify mental health as a problem and stigma.[23] Recently, person centred care (PCC) has been advocated for TB care.[24] Screening tools and training should be available for health care workers and clinicians at primary health centers so that diagnosis of psychological disorders is not missed or delayed. Screening should be done as part of pre-treatment evaluation as well as during follow up visits.

2. Conclusion

Since the discovery of rifampicin and highly effective chemotherapy, the management of TB has been entirely focused on pharmacological treatment. Considering the social and psychological implications of TB,

it is imperative that management of TB should also include the psychological aspects. The national TB elimination program (NTEP) has a treatment success rate of 87%.[2] Inclusion of routine and mandatory psychological evaluation for all patients with TB will result in further strengthening of the program.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Original article

Occurrence of anxiety and depression among homeless individuals with pulmonary tuberculosis

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ABSTRACT

Background: Tuberculosis and mental health issues are global health concern. Homelessness is a serious public health issue. There has been a relationship established between homelessness and mental illnesses. In this study, we see the mental health problems in homeless people with Pulmonary Tuberculosis (PTB).

Methods: PTB patients who were homeless living in shelter in Delhi, aged 22 years and above, were asked questions related to Anxiety and Depression. The tools used were PHQ-2 (patient health questionnaire), GAD-7 (general anxiety disorder), and CESD-R-10 (centre for epidemiologic studies depression scale revised).

Results: Out of 47 PTB patients screened, 4.2% (2, n = 47) had Minimal Anxiety, 51% (24, n = 47) had Mild Anxiety, 40.4% (19, n = 47) had Moderate Anxiety, 4.2% (2, n = 47) had Severe Anxiety, and 95.7% (45/47) had Depression. 78% (37, n = 47) were symptomatic for TB at the time of screening before being diagnosed with PTB and 22% (10, n = 47) were asymptomatic for PTB at the time of screening before being diagnosed with PTB. 34% (16/47) had history of PTB and 66% (31/47) had no history of PTB.

Conclusion: There is a strong occurrence of Anxiety and Depression in homeless people with PTB. Patients who were symptomatic without history of PTB is more than half (53.19%). 22% of the people were asymptomatic at the time of screening, so it can be assumed that people were unaware that they have been suffering from PTB. In India, there is need to assess mental health issues among homeless TB patients on larger sample size. As the burden of mental illnesses is increasing and homeless population remains an unnoticed population.

1. Introduction

Homelessness is a global public health concern that has its own components and complications. Homeless can be categorised in three categories, transitional homelessness, intermittent homelessness, and chronic homelessness.[1] Homelessness lasting for shorter period (not more than a year) due to an unforeseen negative life event (for example loss of employment, separation from loved ones, dislodgement) is defined as transitional or crisis homelessness. Individuals moving in and out of cycles of homelessness repetitively, sometimes switching

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between housing and institutional care (hospitals, prisons, treatment programs) is referred as intermittent homelessness. And, chronic homelessness is homelessness persists for not less than a year or persons with disabling condition undergoing three to four episodes of homelessness in last two years. In India, the term "houseless population," is used to refer the people who do not have houses (i.e., house which has a roof) instead of living in an exposed and unprotected areas like streets, railway platforms, bus stands. India had 4,49,761 such households as per 2011 census.[2] The reliable data available for homeless population in India is very less, which makes it challenging to work for this specific population of India.[3] Research studies suggest that there are multiple factors associated with this state, which is called homelessness. Factors such as dysfunctional family background, unaffordable housing, climate change, migration, social marginalization, poverty, and stability of ruling elite[4] and mental health disorders,[5] can cause the state of homelessness. According to *The Universal Declaration of Human Rights* housing is a fundamental right under *Article 25*, because housing is basic need to meet the normal standards of living for people's health.[6]

Depression and anxiety are two common mental health issues which are of global health concern. Recent studies have shown that the prevalence of anxiety and depression affect the ability to cope up with stress and challenges in daily life of pulmonary tuberculosis patients.[7] Homeless population seems to have more prevalence of mental health problems as compared to the general population.[8–10] Mental illnesses can cause homelessness in a population and vice-versa.[11] Mental health problem constitutes an important risk factor for homeless population due to lack of social support, marginalization, gaps in service delivery systems, and social stigma inside the society and healthcare delivery.[12] The risk of being homeless with mental illness is reported ten to twenty times higher in comparison to general population.[7] Sexually transmitted diseases, Tuberculosis and hepatitis are prevalent in this population and due to lack of access to health care non-communicable diseases like cardiovascular disease, diabetes and mental health problems can be seen more in homeless population than in general population.[13]

According to India TB report 2022, Tuberculosis is a chronic infectious disease caused by *Mycobacterium Tuberculosis* and is one of the leading causes of mortality around the world.[14] The total number of incident TB patients (new and relapse) notified during 2021 was 19,33,381, 19% higher than that of 2020 (16,28,161).[15] As tuberculosis is a chronic illness, it always interferes with life physically, psychosocially, and economically. It can result in unemployment, hospitalization can cause abstention from job, isolation, fear of getting infected, unexplained weight loss, lack of hope, can cause decreased social interaction. In country like India, social stigma is mostly associated with a disease or illness.[15] In a study conducted by Purohit at el, 1978 hospitalized TB patients were suffered from depression.[16] The prevalence of depression and anxiety among tuberculosis patients were 43.4% and 41.5%, respectively. Depression and anxiety disorders can be seen frequently among TB patients.[17]

Mental health problems and Tuberculosis are both globally known public health concerns. In country like India, there are individuals which are homeless due to various factors and do not have TB and/or mental health problems. In this study, we have attempted to study the association between TB and mental health issues in homeless population as homelessness is a serious public health issue.

2. Methods

2.1. Study area

This study has been conducted in June 2022 at the Centre for Equity Studies (CES) recovery shelter, in New Delhi, India where homeless people were living with Pulmonary Tuberculosis. This shelter was located at the '*Yamuna Pusta*' which is near to the bank of Yamuna River. People who lived in that area were mostly homeless and migrated. TB patients were living in proper ventilated dormitory. Each room had 20 patients.

2.2. Study population

All individuals were male, aged 22 years and above living in CES recovery shelter with pulmonary tuberculosis. People were homeless and living in shelter for pulmonary Tuberculosis treatment.

2.3. Study tools

In this study, Patient Health Questionnaire (PHQ-2), General Anxiety Disorder (GAD-7) and Centre for Epidemiologic Studies Depression Scale Revised (CESD-R-10) were used. PHQ-2 is an initial screening tool for depression, GAD-7 is a screening tool for Anxiety and CESD-R-10 is a screening tool for depression and depressive disorder, which is further used for patients who scored 3 or more than 3 in PHQ-2 scale. Personal information was asked from the patients like, gender, age, history of TB, symptoms before diagnosis, and phase of treatments – intensive phase or continuation phase.

3. Results

There were 47 male patients; all of them participated in this study. Out of 47 patients, **37(78.72%)** were *symptomatic* and had at least one symptom out of four symptoms of PTB (cough,

Table 1 – TB patients with anxiety and depression.

Tool	Number of TB Cases with Anxiety and Depression (%)
PHQ-2	34 (72.3%)
GAD-7	
Minimal Anxiety	2 (4.2%)
Mild anxiety	24 (51%)
Moderate Anxiety	19 (40.4%)
Severe Anxiety	2 (4.2%)
CESD-R-10	45 (95.7%)

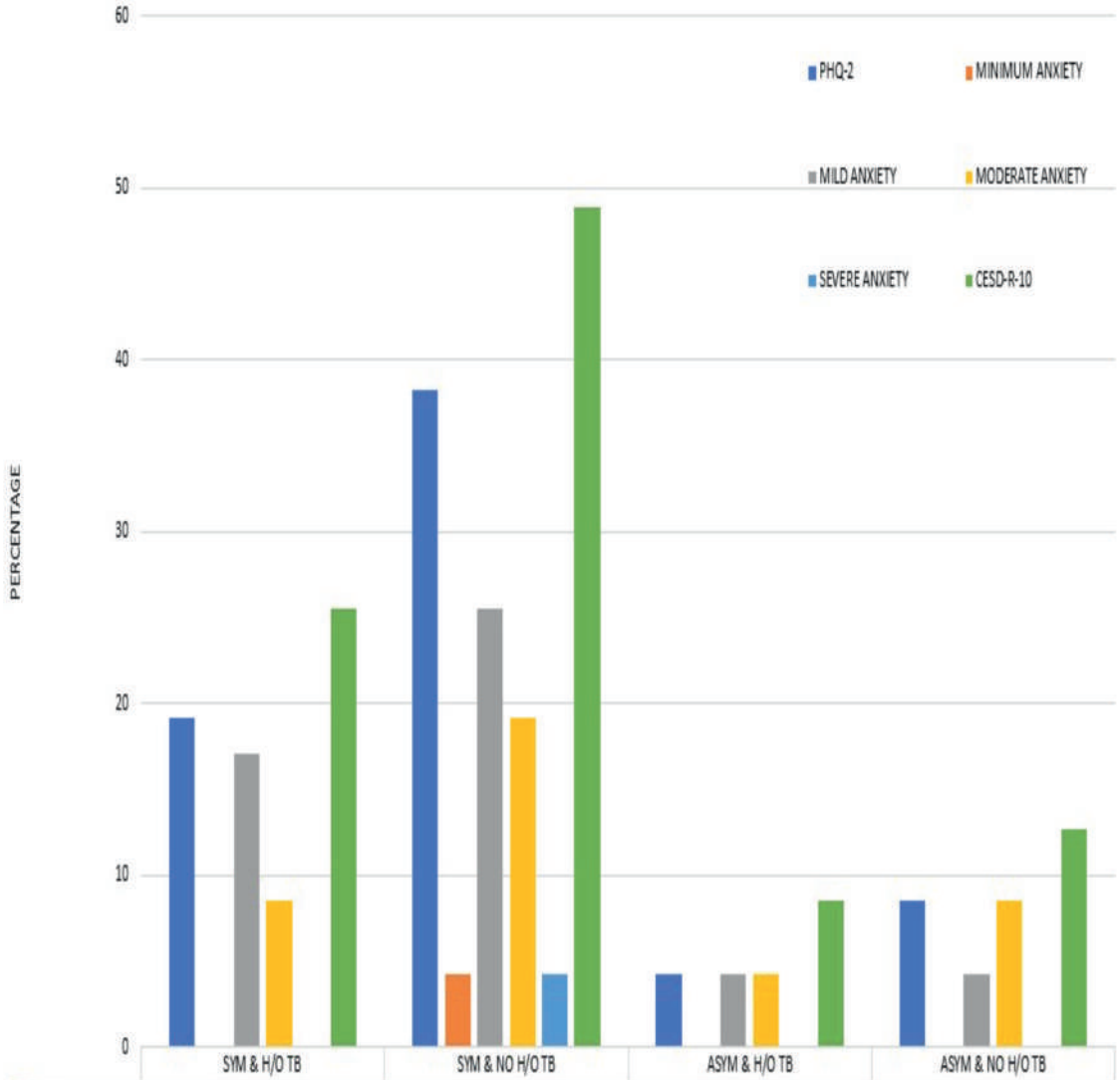
Number of people who scored 3 or more that 3 on PHQ-2 (Patient Health Questionnaire) scale; Number of people who scored between 0 and 4 implied minimal anxiety, score between 5 and 9 implied mild anxiety, score between 10 and 14 implied moderate anxiety and 15 or more that 15 implied severe anxiety in scale GAD-7 (General Anxiety Disorder) and number of people who scored 10 or more in CESD-R-10 (Centre for Epidemiologic Studies Depression Scale Revised).

weight loss, night sweats, fever) at the time of screening. **10(21.27%)** out of 47 patients were *asymptomatic* at the time of screening; 16**(34%)** had *history* of Tuberculosis and **31(66%)** had *no history* of Tuberculosis. After diagnosis out of 47 patients **25(53.19%)** were in *Intensive phase* of the treatment and **22(46.80%)** were in *Continuation phase* of the treatment. In PHQ-2, a participant with the score of 3 or more than 3 was considered depressed. In GAD-7, if the score was in between 0 and 4 it implied minimal anxiety, score between 5 and 9 implied mild anxiety, score between 10 and 14 implied moderate anxiety and score of 15 or above 15 implied severe anxiety. Score 10 or more on CESD-R-10 implied that the participant was depressed.

Table 1 showing Profile of all the patients.

4. Discussion

In this study, we divided patients in four categories based on symptoms and history of TB at the time of screening for PTB as follows:



	SYM & H/O TB	SYM & NO H/O TB	ASYM & H/O TB	ASYM & NO H/O TB
PHQ-2	19.1	38.2	4.2	8.5
MINIMUM ANXIETY	0	4.2	0	0
MILD ANXIETY	17	25.5	4.2	4.2
MODERATE ANXIETY	8.5	19.1	4.2	8.5
SEVERE ANXIETY	0	4.2	0	0
CESD-R-10	25.5	48.9	8.5	12.7

SYM & H/O TB (Symptomatic with History of TB); SYM & NO H/O TB (Symptomatic without History of TB); ASYM & H/O TB (Asymptomatic with History of TB); ASYM & NO H/O TB (Asymptomatic without History of TB)

Fig. 1 – Graphical representation of all four categories with percentage of patients with anxiety and depression i.e., *Symptomatic with history of TB, Symptomatic without history of TB, Asymptomatic with history of TB, and Asymptomatic without history of TB.*

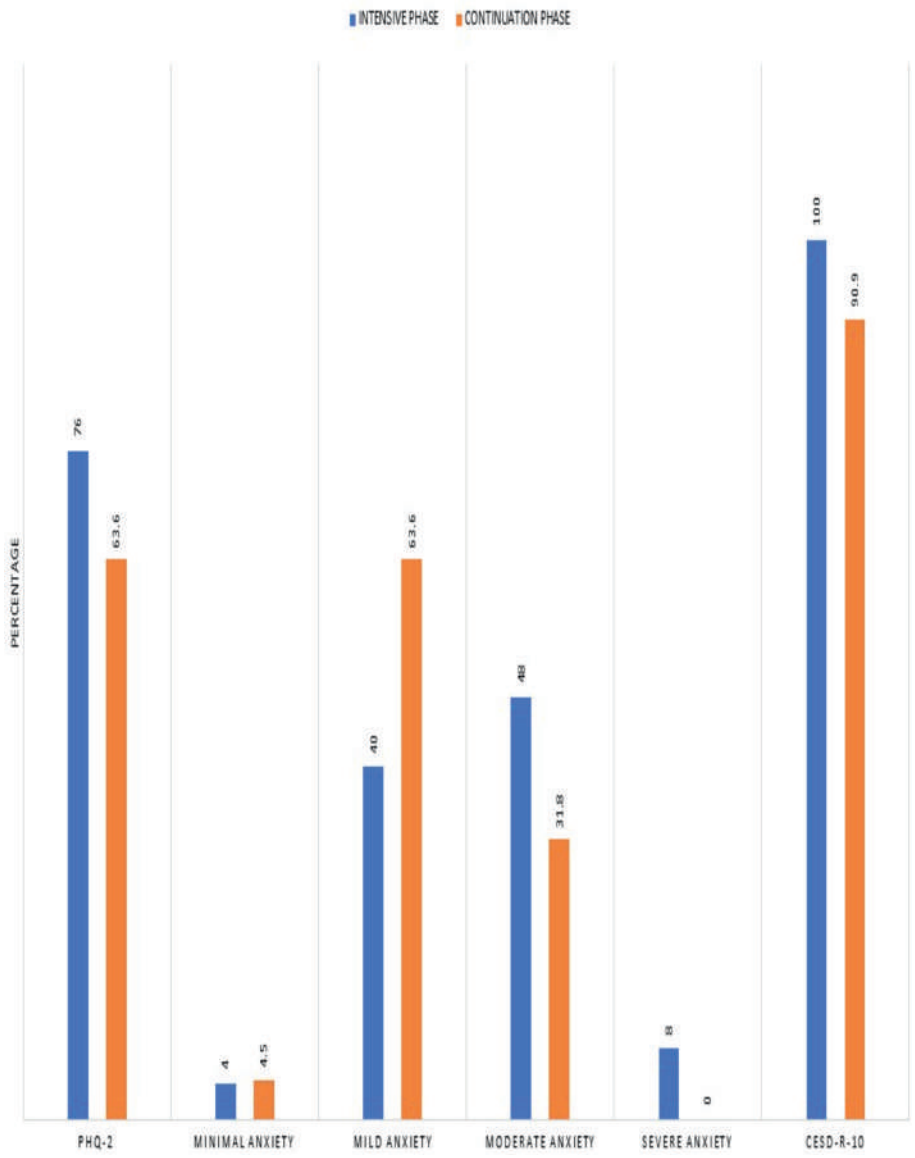


Fig. 2 – Graphical representation of occurrence (in percentage) of anxiety and depression based on the phase of the treatment patients going through i.e., *Intensive Phase and Continuation Phase.*

(i) Symptomatic with history of TB[A1], (ii) Symptomatic without history of TB[A2], (iii) Asymptomatic with history of TB[A3], and (iv) Asymptomatic without history of TB[A4].

In Fig. 1 depicts the occurrence of anxiety and depression of each category. Occurrence of Anxiety and Depression in patients who were *symptomatic without history of TB* is more. It can be assumed that patients who did have symptoms were more susceptible to mental health problems because they were unaware about the disease as compared to the patients who had history of TB and symptomatic at the time of screening. It is because of the fear and lack of knowledge about the disease. The two cases of *severe anxiety* are from this category only. Patients who are a*symptomatic with history of TB* are reported to have least occurrence of anxiety and depression.

In Fig. 2, patients who are in Intensive phase of treatment have shown more occurrence of anxiety and depression. Patients with *severe anxiety* and *moderate anxiety* were in *Intensive Phase*, while in the *Continuation Phase* the occurrence of *minimum anxiety* and *mild anxiety* was more. Occurrence of Depression in Intensive Phase was more as compared to the Continuation Phase. Patients in Intensive Phase of Treatment have high occurrence of Anxiety and Depression as compared to Continuation Phase of treatment. PTB treatment is a long-term treatment and may be the longevity of the treatment is the reason of high occurrence of anxiety and depression. During the Intensive phase patient still has symptoms but in Continuation phase patient does not have any symptoms, may be because of this reason high occurrence of depression and anxiety can be seen.

5. Limitations

All the individuals participated in this study were men. Larger sample size is needed to analyse the implications of this study at national level.

6. Conclusion

High occurrence of depression and anxiety in homeless people with Tuberculosis was seen. In this study, it was seen that people who were symptomatic at the time of screening for TB and without history of Tuberculosis were more prevalent to depression and anxiety. It can be because of the fear, lack of knowledge, social stigma associated with TB. Duration of TB treatment is long. The lack of knowledge about TB and its treatment can be one of the reasons for anxiety and depression in patients during the treatment. There is a need for interventional strategies to target this specific population of homeless people for diagnosis of both TB and mental health issues. There are not much studies related to homeless population in India because of the gap between homeless population and healthcare system. This study shows the association of mental health problems and TB in homeless population. In India there are not many studies have been conducted to assess mental health problems in homeless population TB. In future, a study can be conducted on a homeless population with large sample size to get more scientific insights and evidence.

Data management and analysis

Data were checked for the errors and were analysed using Microsoft Excel.

Ethics approval

An informed written consent was taken by the Centre for Equity Studies for PTB patients living in the shelter for treatment. The contents of which are explained to the patients in their local language. The benefits, procedure and risks were explained to all the participants.

Conflicts of interest

The authors have none to declare.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.ijtb.2022.11.003.

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Original article

Depression and stigma experience among patients with tuberculosis in urban and rural settings

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ABSTRACT

Background: Tuberculosis is one of the leading causes of morbidity and mortality in the globe. The most common infectious disease-related death in the world is tuberculosis. In 2020, an estimated 9.9 million people became ill with tuberculosis (TB), translating to 127 cases per 100,000 people. The stigma associated with tuberculosis (TB) causes people to put off seeking treatment and adhering to their treatment regimen. India has the highest prevalence of tuberculosis in the world. Depression and stigma oftem co-exist in people with tuberculosis.

Objective: To estimate the prevalence of depression and stigma experience among patients with tuberculosis, and to determine the association of socio-demographic variables and stigma experience with depression in urban and rural field practice areas.

Methodology: This is a cross-sectional study where purposive sampling method was adopted. A house-to-house and phone interview was conducted using a pre-designed, pre-tested questionnaire. Depression was assessed using the PHQ-9 and stigma experience was assessed using the Stigma Scale for Chronic Illness - 8 items (SSCI -8 Items). SPSS version 25 was used (licensed to the institution)for analysis. Descriptive statistics was used to calculate proportions, mean, standard deviation. Inferential statistics like Chi-square analysis/Fisher's exact analysis were used to find the association between various socio-demographic variables with the depression among patients with tuberculosis and association between stigma experience and depression. (Yates continuity Highlights correction applied wherever required) $p < 0.5$ was considered to be statistically significant.

Results: The overall prevalence of depression was 57.8%. The association between number of family members and type of tuberculosis with depression was statistically significant. 28.6% did not experience stigma, while 71.6% did. The association between depression score and stigma experience was not statistically significant.

Conclusion: More than half of the study's participants had depression and had encountered stigma. There was significant association between depression scores with family size and type of tuberculosis.

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1. Introduction

Tuberculosis (TB), caused by mycobacterium tuberculosis, is one of the leading causes of morbidity and mortality worldwide. The most common infectious disease-related death in the world is tuberculosis. TB is primarily a disease of the poor, with higher prevalence in people living in socially disadvantaged communities or those living in substandard living conditions, as defined by a lack of education, substandard housing, inadequate nutrition, overcrowding, and socioeconomic factors.[1]

Ending the TB epidemic by 2030 is one of the United Nations' Sustainable Development Goals (SDG). The first milestone of the End TB Strategy for TB incidence is a 20% decrease from 2015 to 2020 in the number of new and relapsed cases per 100,000 people. Following targets for reductions of 80% by 2030 and 90% by 2035, the next target in 2025 is a 50% reduction compared to 2015. In 2020, an estimated 10 million people worldwide contracted TB, with the best estimate being 9.9 million, or 127 cases per 100,000 people. TB mortality estimate for 2020 should be viewed as provisional. According to WHO, there were 1.3 million TB deaths worldwide between 2019 and 2020, an increase of 1.2 million.[2]

There is still stigma associated with tuberculosis (TB) in many communities, which prevents the patients to seek treatment and adhere to their treatment regimen.[3] These circumstances can impede the early detection, treatment, and recovery of TB patients, which can also cause patients grief and psychological distress.[4,5]

Because of their undesirable characteristics, this method of social control involves labeling, marginalizing, stereotyping, and isolating the individual from larger society. Stigma is a social determinant of health that has been shown to be a significant barrier to receiving medical care and thus delaying diagnosis, managing illness, and completing treatment. TB-related stigma is typically caused by fear of infection. Because they are unaware of the disease, people believe tuberculosis is incurable and highly contagious during treatment. Inappropriate media information, such as fragmented or incorrectly presented material, can occasionally promote societal stigma associated with tuberculosis.[6]

However, because tuberculosis has historically been recognized as contagious and dangerous, social acceptance of tuberculosis patients may be seriously compromised in society. These TB patients have a wide range of psychosocial disorders, such as sadness, anxiety, and feelings of loneliness as well as social exclusion and stigmatization.[7] One of the most common mental illness, tuberculosis patients' exhibit is depression. The effort results in suicidal thoughts and varying degrees of social and professional dysfunction. People frequently have depression and tuberculosis simultaneously.[8] When depression coexists with tuberculosis, the risk of other co-morbidities increases, the patient may experience worse symptoms, and the cost of treatment increases. Depression may also increase the risk of TB reactivation caused by a weakened immune system or a failure to practice self-care.[9]Negative results are more likely when patients do not comply to their treatment plan, but also has the potential to endanger public health for either localized spread or the establishment of treatment resistance, psychosocial issues like stigma, social isolation, side effects of treatment, a insufficient social support, the absence of hope and other behavioral responses to learning of the TB diagnosis. When depression co-occurs with tuberculosis, it leads to a lower quality of life, poor adherence to anti-TB medications, and eventually death.[10–12]

Hence, in the current study we aim to understand stigma experience and depression among patients with tuberculosis in urban and rural field practice areas of the Department of Community Medicine at JSS Medical College.

2. Materials and methods

It is a cross-sectional study, conducted in the rural (Kadakola, Sutturu, Hadinaru) and urban (Bannimantap and JSS Public Health center) field practice areas of JSS Medical College, Mysuru for a duration of six months. Two urban (Bannimantap, Medhar block) and three rural (Hadinaru, Sutturu, and Kadakola) field practice areas were selected for the study. In each of the field practice areas, those who were diagnosed with tuberculosis in the past 4 years and provided consent to participate in the study were included in the interview. Hence, purposive sampling was adopted. After obtaining Ethical Committee Clearance, the data was collected with a standardized validated, pre-designed questionnaire. The components of the questionnaire included (1) Socio-demographic profile (Age, place of residence, education, occupation, type of family, socioeconomic status, etc), (2) SSCI- 8 Stigma experiences[13] and (3) PHQ-9 Questionnaire[14] for assessment of depression. For stigma experience participants who had answered yes for any one of the questions were considered to have experienced stigma.. Study participants who had minimal and no depression scoreswere considered as (PHQ-9 score 0–4) no depression and those who's scores suggested mild depression, moderate depression, moderately severe depression and severe depression (PHQ-9 score was 5–27) were considered depressed. The data was entered in Microsoft excel and analyzed using SPSS V 25 (licensed to the institution). Mean, standard deviation, and percentage were used as descriptive statistics for continuous and categorical variables. As required, graphs and tables were employed. Statistical inferences, such as the Fisher's Exact Test and the Chi–Square Test (Yates continuity correction) were used to determine the relationship between socio-demographic factors and stigma experience with depression. Statistical significance was defined at p-value 0.05.

3. Results and discussion

Out of 169 participants, majority 22.40% were the age range of 26–35 years followed by 46–55 (22.0%), 36–45 years (19.0%), 15–25 years (17.10%), 56–65 years (11%), 66–75 years (4.14%), 5–14 years (3%), and 76–85 years (1.70%). 57.4% were males followed by females 72 (42.60%). With respect to education, majority 49 (29%) were illiterate while only 2 (1.2%) had completed post-graduation. 102 (60.40%) were living in rural

and 67 (39.60%) were living in urban areas. 76 (45%) of the participants were unemployed, while 50 (29.60%) were engaged in skilled work, 29 (17.20%) were engaged in semi-skilled work rest 14 (8.30%) were engaged in unskilled work.

105(62.10%), 63(37.50%), and 1 (0.60%) belonged to nuclear, three generation and joint family respectively.

As per the modified BG Prasad (2019) socio-economic status scale, 133 (78.70%) of the study participants belonged to a socioeconomic class I (Rs per capita income 7008 above per month), 25 (14.80%) of the study participants belonged to social class II (per capita income 3504–7007), 7 (4.10%) belonging to social class III of the study population. (Per capita income Rs 2102–3503 per month), 1 (0.60%) belonged to social class IV (Rs per capita income 1051–2101 per month), and 3 (1.80%) belonged to social class V (per capita income Rs 1050 per month and below).

Majority of 129 (76.30%) were married, 35 (20.70%) were never married, and 5 (3%) were widowed and Out of 134 married and widowed study participants, 131 (98%) were having children, while 3 (2%) were don't have children. Out of

Table 1 – Distribution of study participant's socio-demographic characteristics.

Sl. no.	Variable	Category	Frequency (n = 169)	Percentage
1	Age	05–14 years	5	3%
		15–25 years	29	17.0%
		26–35 years	38	22.40%
		36–45 years	32	19%
		46–55 years	37	22%
		56–65 years	18	11%
		66–75 years	7	4%
		76–85 years	3	1.6%
2	Gender	Male	97	57.40%
		Female	72	42.60%
3	Education	Illiterate	49	29%
		Primary School	17	10.10%
		Middle School	23	13.60%
		High School	32	18.90%
		PUC	27	16%
		Graduation	19	11.20%
		Post-graduation	2	1.2%
4	Occupation	Unemployed	76	45%
		Unskilled	14	8.30%
		Semiskilled	29	17.20%
		Skilled	50	29.60%
		Semiprofessional	0	0
		Professional	0	0
5	Place of Residence	Urban	102	60.40%
		Rural	67	39.60%
6	No. of Family Members	Less than or equal to 5	131	78%
		More than 5	38	22.30%
7	Total Family Income	1000–10,000	69	41%
		10,001–20,000	80	47.30%
		20,001–30,000	16	9.50%
		30,001–40,000	5	1.80%
		40,001–50,000	1	0.50%
8	Socioeconomic status according to B.G Prasad	Upper class	133	78.70%
		Upper middle class	25	14.80%
		Middle class	7	4.10%
		Lower middle class	1	0.60%
		Lower class	3	1.80%
9	Marital status	Married	129	76.30%
		Never married	35	20.70%
		Widow	5	3%
		Divorced	0	0
10	Children present (n = 134)	Yes	131	97.8%
		No	3	2.2%
11	Number of children (n = 131)	Less than or equal to 2	95	73%
		More than 2	36	27.50%
12	Type of Tuberculosis	Pulmonary Tuberculosis	97	57.40%
		Extra Pulmonary Tuberculosis	72	42.60%
13	Year of diagnosis of Tuberculosis	2018	26	15.31%
		2019	32	19%
		2020	50	26.60%
		2021	61	36%

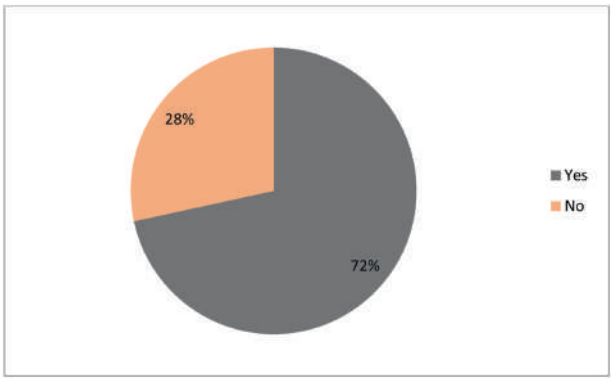

Fig. 1 – Proportion of study participants with stigma experience.

131 study participants, 95 (72.5%) were having children less than or equal to 2, and 36 (27.5%) had children more than 2. With respect to the type of tuberculosis, majority of them 97 (57.40%) were patients with Pulmonary tuberculosis and 72 (42.60%) had extra pulmonary tuberculosis.

Majority of participants, 61 (36%) were diagnosed to have tuberculosis in 2021, 50 (29.60%) diagnosed in 2020, 32 (19%) in 2019, and 26 (15.3%) in 2018 26 (15.30) (Table 1).

Out of 169 study participants, 71.6% of them had stigma experience (Fig. 1), and the distribution of stigma experience according to SSCI-8 Scale is displayed as in Fig. 2, Table 2.

According to PHQ-9 scale, 12% had no deepression, 30.2% had minimal depression, 34% had mild depression, 21% had moderate depression, 2.3% had moderate severe depression and 0.5% had severe depression. Among those who were depressed (mild, moderate, moderately severe and severe), 75.5% of the pulmonary tuberculosis participants had depression, and 24.5% of the extra pulmonary participants had depression this difference was statistically significant (chi-square – 31.300 and p-value <0.001).

In the No. of family members who had less than or equal to five members 70.4% of had depression, and who had more than five members 29.6% of the participants had depression. There was statistical significant association seen between number of family members and depression (chi-square – 6.759 and p-value 0.009).

Gender, literacy, occupation, type of family, socio-economic status, marital status, number of children, and the year of diagnosis of tuberculosis did not show statistically significant association with depression (Table 3).

Among those who had stigma experience, 41.2% did not have depression and 57.9% had depression. Among those who never had stigma experience 41.7% of the participants did not have depression and 58.3% of them had depression. However there was no statistically significant association found between the presence of depression and stigma experience (p-value 0.954) (Table 4).

4. Discussion

4.1. *Prevalence of depression*

In the present study 57.8% of tuberculosis patients were found suffering from depression, among which 34% experienced mild depression, 21% moderate depression, 2.30% moderate severe depressed and 0.50% severe depressed. In the study done by Sharma et al. 9.7% were mild depression and 2.1% were moderate depressed.[15]

The present study shows that the prevalence of depression was lower than that found in Vishwakarma et al. study which showed that 64% of TB patients had either moderate or severe depression[16] and Sulehri et al. which showed the prevalence to be 80% (45.8% were moderate depressed and 37.5% were severe depressed).[17] Another study by Salodia et al. Depression was found to be prevalent in 23.6 percent of TB patients[18] which was lesser than that found in our study.

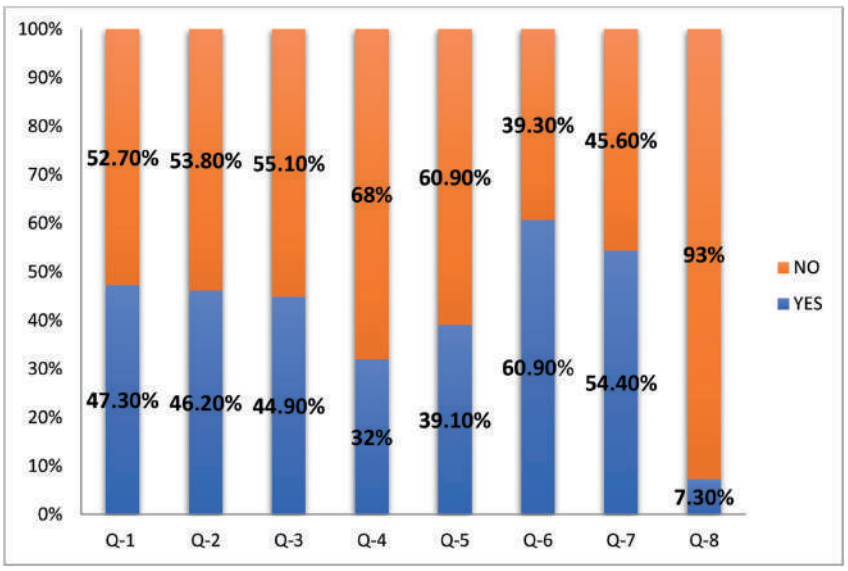

Fig. 2 – Distribution of study participants based on their stigma experience according to SSCI-8 Scale.

Table 2 – Distribution of study participants based on their stigma experience according to SSCI-8.

Stigma Experience Questions	Yes	No
Because of my illness, Some people seemed uncomfortable with me (Q1)	47.30%	52.70%
Because of my illness, Some people avoided me (Q2)	46.20%	53.80%
Because of my illness, I felt left out of things (Q3)	44.90%	55.10%
Because of my illness, people were unkind me (Q4)	32%	68%
Because of my illness, people Avoided looking at me (Q5)	39.10%	60.90%
I felt embarrassed about my illness (Q6)	60.90%	39.30%
I felt embarrassed because of my physical limitations (Q7)	54.40%	45.60%
Some people acted as though it was my fault, I have this illness (Q8)	7.30%	93%

4.2. *Socio-demographic characteristics and depression*

Number of family members was found to be significantly associated with depression in this study. This might be probably because of the consequent financial and social implications secondary to contracting tuberculosis.

The type of tuberculosis also was associated significantly with depression. Among those with pulmonary tuberculosis had increased prevalence of depression. This is similar to the findings of Dahiya's et al. noticed that depression was more prevalent (86.8%) in patients with pulmonary TB.[19] But, in Adem et al. Study it was observed that higher proportion (21.86%) of pulmonary tuberculosis patients had depression, but this was not statistically significant.[20]

The present study shows that 63.3% of the male participants had depression when compared to female participants with 36.7% depression. This finding is similar to Dahiya et al study which also showed that the majority of male participants had depression 67.9%.[19]

In our study, we found that literate participants had more depression 73.5% compared to illiterate 26.5%. Salodia et al. study also had similar findings with literates having higher depression (24.4%).[18]

In the present study depression was found in major among employed (61%), and this finding deferred from Salodia et al. study which showed findings that depression was more among those unemployed (37.1%).[18]

In the present study, participants who were living in rural area had more depression 66.3% when compared to those who living in urban areas 33.7%. Dahiya et al. study showed similar findings that people who were living in urban areas had more depression 56.6%.[19] The findings of our study might be due to the lack of awareness and access to health care facilities in rural areas compared to urban setting.

In the present study participants those who were living in nuclear families had more (57.1%) depression contrary to Dahiya et al. study wherein those living in joint families had more depression 77.3%.[19] The findings in our study might be due to lack of social support.

In our study people who belonged to upper class 94.9% had higher rates of depression. According to study done by Salodia

Table 3 – Association between socio-demographic profiles and depression score.

Sl. no.	Variables	Category	Depression	No depression	Total (n) = 169
1	Gender	Male	62 (63.3%)	35 (49.3%)	97
		Female	36 (36.7%)	36 (36.7%)	72
2	Education	Illiterate	26 (26.5%)	23 (32.4%)	49
		Literate	72 (73.5%)	48 (67.6%)	120
3	Occupation	Unemployed	38 (38.8%)	38 (53.5%)	76
		Unskilled	7 (7.1%)	7 (9.9%)	14
		Semiskilled	20 (20.4%)	9 (12.7%)	29
		Skilled	33 (33.7%)	17 (23.9%)	50
4	Place of Residence	Rural	65 (66.3%)	37 (52.1%)	102
		Urban	33 (33.7%)	34 (47.9%)	67
5	Type of Family	Joint Family	56 (57.1%)	49 (69%)	105
		Nuclear Family	42 (42.9%)	22 (31%)	64
6	No. of Family members	Less than or equal to 5	69 (70.4%)	62 (87.3%)	131
		More than 5	29 (29.6%)	9 (12.7%)	38
7	Socio-economic status	Lower class	5 (5.1%)	6 (8.5%)	11
		Upper class	93 (94.9%)	65 (91.5)%	158
8	Marital Status	Married	79 (80.6%)	50 (70.4%)	129
		Single	19 (19.4%)	21 (29.6%)	40
9	If you have children, how many children	Less than or equal to 2	48 (72.7%)	47 (72.3%)	95
		More than 2	18 (27.3%)	18 (27.7%)	36
10	Type of Tuberculosis	Pulmonary Tuberculosis	74 (75.5%)	23 (32.4%)	97
		Extra Pulmonary Tuberculosis	24 (24.5%)	48 (67.6%)	72
11	Year of diagnosis of Tuberculosis	2018	20 (20.4%)	6 (8.5%)	26
		2019	17 (17.3%)	14 (19.7%)	31
		2020	29 (29.6%)	22 (31%)	51
		2021	32 (32.7%)	29 (40.8%)	61

*Numbers in the parenthesis represent row wise percentage.

Table 4 – Association between depression score and stigma experience.

Sl. no.	Stigma experience	No Depression (n = 71)	Depression (n = 98)	Total	Chi-square	p-value
1	Yes	51 (41.2%)	70 (57.9%)	121	0.003	0.954
2	No	20 (41.7%)	28 (58.3%)	48		

*Numbers in the parenthesis represent row wise percentage.

et al. the study findings socioeconomic class was statistically significant with depression and participants who belonged to low socio-economic status had more depression rate of 31.6%.[18]

The present study shows that married participants had more depression 80.6% and this was not statistically significant. According to study done by Adem et al. widowed tuberculosis patients had more depression (36.36%).[20,20] According to study done by Salodia et al. single/separated participants had more depression (25.3%)[18] though this variable was not found to be statistically significantly associated. In the present study, less than or equal to two children had more depression 72.7%, but it was not found to be statistically significant.

4.3. *Stigma experience and depression*

The present study shows that stigma experience was not statistically associated with depression (chi-square – 0.003, p-value 0.954). According, to the study Yilmaz et al.[21] there was a significant positive correlation found between total TPSS (Tuberculosis Patients Stigma Scale) score and total HAD-A (Hospital Anxiety and Depression Scale-anxiety) score, total HAD-D (Hospital most Anxiety and Depression Scale-depression) score ($p < 0.05$). The differences in the findings might be due to the difference in the stigma scales that were used. The strength of this present study is usage of standardized and validated questionnaire (PHQ-9 and SSCI -8) for the assessment of depression and stigma experience among TB patients. The limitation would be that PHQ -9 (Patient health questionnaire- 9) and SSCI-8 (Stigma scale for chronic illness – 8 items) being screening tool of prevalence of depression has its limitations. The study was conducted in a smaller sample size.

5. Conclusion

More than half of tuberculosis patients had depression. There was association between number of family members and type of tuberculosis with depression statistically significant. 71.6% of the study participants experienced stigma and 28.4% did not. There was association between stigma experience with depression not statistically significant in our study. This study recommended that increased need for counseling and education of TB patients and the community to prevent stigma. Removing the knowledge gap with respect to morbidity, and catering to psychosocial needs, and lowering structural and behavioral barriers in health systems. Qualitative studies in this direction would help further us understand stigma experiences, its associated factors and mental health aspects of tuberculosis patients.

Conflicts of interest

The authors have none to declare.

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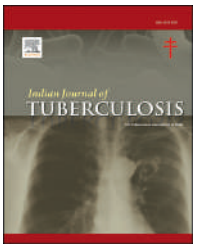

Original article

Nutritional status and adherence to anti-tubercular treatment among tuberculosis patients in a community development block of Eastern India

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ABSTRACT

Background: Undernutrition is a risk factor for developing tuberculosis (TB) and adherence to treatment leads to successful treatment outcomes.

Objectives: To assess the nutritional status and adherence to treatment among tuberculosis patients in Bhatar Community Development Block of Purba Bardhaman district, West Bengal, India.

Material & methods: A cross sectional descriptive study was conducted among all the 82 tuberculosis patients registered between April to June, 2021, under NTEP in Bhatar tuberculosis unit (TU), who completed at least 1 month of therapy. Nutritional status was assessed based on BMI and adherence to treatment was evaluated by interviewing with a validated version of Morisky Medication Adherence Scale (MMAS-8-Item). Data was analysed using SPSS v23.

Results: Among the 82 subjects, 51 (62.2%) were found to be underweight and overall high level of adherence to treatment was found among 51 (62.2%) of study subjects. Subjects aged >45 years (AOR 3.686, 95% CI: 1.147–11.842) and having extra-pulmonary Tuberculosis (AOR 8.539, 95% CI: 1.305–55.871) were significantly associated as being adherent to treatment.

Conclusion: Health education, awareness and more vigilant monitoring is still needed so that TB patients can be cured successfully. Special attention needs to be given on the nutritional status of the TB patients.

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1. Introduction

Tuberculosis, a major cause of ill health, is one of the top ten causes of death globally and the leading cause of death from a single infectious agent. About one fourth of the global population is infected with *Mycobacterium tuberculosis* and at risk of developing the disease. There were an estimated more than 1.4 million deaths due to tuberculosis (TB) reported globally in the year 2019.[1]

Although the incidence rate of TB is decreasing globally but not up to the mark to achieve the targeted milestones. There is a 25% reduction in incidence rate and 35% reduction in deaths due to TB between 2015 to 2021.[1] To combat the global scenario, Global tuberculosis (TB) targets were set as part of the World Health Organization's End TB Strategy (2016–2035) and the Sustainable Development Goals (2016–2030). The 2030 targets are a 90% reduction in TB deaths and 80% reduction in TB incidence compared with 2015 levels.[2]

In India, the National Strategic Plan (NSP 2017-25) has framed appropriate strategies under broad themes of Prevent, Detect, Treat and Build pillars for universal coverage and social protection for ending TB. Till date, the state/UTs of Kerala, Lakshadweep, Puducherry have already claimed TB free status and another 67 districts across the country are on the path of TB free status.[3]

To achieve "End TB by 2025" goal, we have to focus not only in case detection and treatment but also improved standard of living and good nutrition. Under nutrition increases the risk of relapse and death due to TB by increasing the severity of the disease, toxicity and mal-absorption of anti-tubercular drugs (ATD).[4,5] It was observed that severe under-nutrition at diagnosis was associated with a twofold higher risk of death due to TB.[4] In line with WHO, Govt. of India adopted and implemented the recommended nutritional assessment and support as an integral part of management by introducing Nikshay Poshan Yojna (NPY) and Direct Benefit Transfer (DBT) Scheme since 2018. In 2018, 14% population of India was under nourished[6] and National Tuberculosis Elimination Programme (NTEP) is one of the first health programmes in India to provide monetary benefits to support nutrition of the TB patients.[3]

Apart from nutrition, adherence to treatment is another important aspect of TB treatment. Adherence is defined by WHO as "the extent to which a person's behavior-taking medication, following a diet, and or executing lifestyle changes, corresponds with agreed recommendations from a health care provider".[7] Adherence to TB treatment is influenced not only by social, cultural and economic factors but also by knowledge and attitude of patients towards TB and various studies had identified these factors.

There is dearth of information on both nutritional aspect and adherence to TB treatment in rural India, more so in Eastern India and the associated factors responsible. With the above background, the present study was conducted to assess the nutritional status of the tuberculosis patients registered during the second quarter of 2021 under Bhatar tuberculosis unit (TU) of Purba Bardhaman district, to find out their adherence to anti-tubercular treatment (ATT) and to find out the association between nutritional status and adherence to treatment with sociodemographic characteristics, if any.

2. Materials and methods

A community based, descriptive, cross sectional study was conducted in Bhatar community development (CD) block of Purba Bardhaman district, West Bengal, from July to December 2021. All TB patients registered under National Tuberculosis Elimination Programme (NTEP), who are drug sensitive, in Bhatar TU from 1st April 2021 to 31st June 2021 and receiving Anti-tubercular drugs (ATD) for at least 1 month was studied. Total enumeration of all eligible cases was done. Seriously ill patients, pregnant women, multi-drug resistant TB patients and those patients who were unavailable after two household visits were excluded from the study.

2.1. Data collection

Data were collected after obtaining ethical approval from the Institutional Ethics Committee of Burdwan Medical College. Prior to data collection, the respective health authorities were intimated about the purpose of this study; their permission and co-operation were sought.

Details of registered tuberculosis cases, including their addresses, were obtained from the DTC or TU. With the help of grass-root level health workers like ASHA, households of the cases were visited. Two attempts were made to reach the study subjects. After briefing the purpose of this study and assuring about the confidentiality of information, informed consent was taken from each of the subjects.

2.2. Data collection tools

i) A pre designed, pre tested semi-structured schedule was used to collect data on demographic and socio-economic factors.
ii) Anthropometric measurement of height (centimeter) and weight (kilogram) was done using measuring tape and portable weighing machine. Underweight was defined as BMI of less than 18.5 kg/meter^2 for subjects >18 years of age and in case of subjects aged <18 years, BMI less than -2SD was considered as underweight as per WHO reference growth standard[8], and BMI of <16 kg/meter,^{2} 16–16.9 kg/meter,^{2} 17–18.49 kg/meter^2 were considered as severe, moderate and mild underweight respectively.[9]
iii) Adherence to treatment was measured using Morisky Medication Adherence Scale (MMAS-8-Item). It is a standardized scale to measure medication adherence which was validated in India.[10,11] It has 8 items. Response choices are "Yes" or "No" for items 1 through 7 and Item 8 has a five-point Likert response scale. Each "No" response is rated as 1 and each "yes" response is rated as 0 except for item 5, in which "Yes" is rated as 1 and "No" is rated as 0. For Item 8, the code (0–4) has to be standardized by dividing the result by 4 to calculate the summated score. Total scores on the MMAS-8 ranges from 0 to 8. Predetermined cut-points were considered. Adherence levels were classified as high (= 8 points), medium (>6 to <8 points) and low (<6 points). For the purpose of comparison, participants with medium and low levels of adherence were considered as

non-adherent and those with high level of adherence were considered as adherent to medication.

2.3. Data analysis

Data were organized and presented applying the principles of descriptive statistics in the form of tables and diagrams as well as calculating proportions. Association between categorical variables like demographic, socio-economic and clinical variables were checked using Pearson Chi square tests. The multivariable logistic regression analysis was performed to predict the factors associated with adherence to treatment. All the variables which showed a p value <0.25 in the univariate analysis, or if the variable was of known clinical importance were included in the final model. Data was analyzed using Statistical Package for the Social Sciences (IBM SPSS statistics for Windows, version 23.0). P value $\leq$ 0.05 was considered as statistically significant.

2.4. Ethical considerations

Ethical approval was taken from the Institutional Ethics Committee of Burdwan Medical College and Hospital, West Bengal (Memo No: BMC/I.E.C./270). Prior to data collection, informed consent was taken from all study participants. Confidentiality and anonymity of information was also strictly maintained.

3. Results

There were 91 TB patients who were registered under National Tuberculosis Elimination Programme (NTEP) in Bhatar TU during the second quarter of 2021 i.e., from 1st April 2021 to 31st June 2021. Among them nine (5 MDR cases, 3 were not found at home in spite of two visits and one person was reported dead before data collection) patients were excluded from the study. Thus, total of 82 patients were included in the study.

3.1. Socio-demographic characteristics

It was noted that, among the 82 study subjects, the mean age was 46.8 years with SD $\pm$ 16.3. Among them 65 (79.3%) study subjects were male and 17 (20.7%) were females; 63 (76.8%) were Hindus and 19 (23.2%) belonged to Islam religion by faith. There were 35 (42.7%) study subjects who belonged to the general caste followed by 21 (25.6%) and 26 (31.7%) study subjects who were from SC and ST caste respectively. 67 (81.7%) of them were married, 12 (14.6%) were un-married and 3 (3.7%) were widows. More than half (53.7%) of them belonged to joint families and 38 (46.3%) were from nuclear families. Most of them (43.9%) were illiterate followed by 19.5% having non formal education and 15.9% having education upto primary level. Among them nearly 2/3rd were unemployed and 1/3rd were employed. More than half (54.9%) of them belonged to the lower middle class of socio-economic status, followed by middle class (25.6%), lower class (15.9%) as per Modified B.G.Prasad Scale.

3.2. Clinical characteristics

From the study it was found that 68 (82.9%) study subjects were registered as new cases and 14 (17.1%) were other types of cases. Among them 71 (86.6%) had Pulmonary TB and 11 (13.4%) had Extra-pulmonary TB. None of them were found to be sero-positive. Only 5 study subjects were suffering from diabetes. Among the study subjects 31 (37.8%) had a past history of alcoholism; more than two-third (67.1%) were smokers while nearly one third were non-smokers.

Majority of them (81.7%) had no history of suffering from TB in the past, whereas only 18.3% had a past history of TB. It was also noted that 22 (26.8%) study subjects had family members diagnosed with TB in the past whereas 60 (73.2%) had no similar family members.

3.3. Nutritional status

Among the 82 subjects, 3 male subjects were under 18 years of age. Their age and BMI were: 10 years with BMI 18.11 kg/m^2, 14 years with BMI 14.91 kg/m^2 and 17 years with BMI 16.82 kg/m^2. According to WHO reference growth standard, nutritional status of the first study subject was normal (between 0 and +1 SD), and the other two had low-BMI for age or thinness (between − 3SD to − 2 SD). It was observed that among the rest of the 79 study subjects, 49 (62%) study subjects were underweight and 30 (38%) study subjects had normal nutritional status where the score of BMI for underweight was considered as <18.5 kg/m^2. For comparison purpose, thus total 51 (49 + 2) study subjects i.e., 62.2% (51/82) were considered as underweight and 31 (30 + 1) i.e., 37.8% were considered as having normal nutritional status.

It was also noted that, out of 51 underweight subjects, 20 (39.2%) were severely underweight, 13 (25.5%) were moderately underweight and 18 (35.3%) were mildly underweight.

Association between categorical variables like socio-demographic characteristics and known clinically important variables using Pearson Chi square tests showed that none of the above variables was found to be statistically significant with nutritional status of the study subjects (Table 1).

3.4. Adherence

Adherence to anti tubercular treatment using MMAS 8 was found to be low in 10 (12.2%) study subjects, medium in 21 (25.6%) and high in 51 (62.2%) study subjects. For comparison purposes, low and medium level of adherence was considered as non-adherent and high level of adherence as adherent to treatment. Therefore, it was found that, out of 82 study subjects, 51 (62.2%) were adherent and 31 (37.8%) were non-adherent to treatment.

In multivariable logistic regression, it was noted that, tuberculosis patients aged more than 45 years were 3.686 (95% CI: 1.147–11.842) times more likely to be adherent to treatment as compared to patients aged less than 45 years and extra-pulmonary TB patients were 8.539 (95% CI: 1.305–55.871) times more likely to be adherent to treatment as compared to pulmonary TB patients. Other variables like gender, education, occupation, SES, past history of alcoholism was not found to be statistically significant (Table 2).

Table 1 – Association between nutritional status and background characteristics of the study subjects (n = 82).

Background characteristics	Total No (%)	Nutritional status		Statistical test	
		Undernourished No (%)	Normal No (%)	Chi square value (df)	p value
Age (in years)					
≤45	32 (39)	17 (53.1)	15 (46.9)	1.836 (1)	0.243
>45	50 (61)	34 (68)	16 (32)		
Gender					
Male	65 (79.3)	43 (66.2)	22 (33.8)	2.090 (1)	0.169
Female	17 (20.7)	8 (47.1)	9 (52.9)		
Education					
Illiterate	36 (43.9)	24 (66.7)	12 (33.3)	0.546 (1)	0.499
Literate	46 (56.1)	27 (58.7)	19 (41.3)		
Occupation					
Unemployed	54 (65.9)	36 (66.7)	18 (33.3)	1.345 (1)	0.337
Employed	28 (34.1)	15 (53.6)	13 (46.4)		
SES[a]					
Upper + Upper middle + Middle	24 (29.3)	13 (54.2)	11 (45.8)	0.930 (1)	0.453
Lower middle + Lower	58 (70.7)	38 (65.5)	20 (34.5)		
Past h/o alcoholism					
Yes	31 (37.8)	22 (71)	9 (29)	1.631 (1)	0.245
No	51 (62.2)	29 (56.9)	22 (43.1)		
Clinical type of TB					
Pulmonary	71 (86.6)	47 (66.2)	24 (33.8)	3.605 (1)	0.092
Extra-pulmonary	11 (13.4)	4 (36.4)	7 (63.6)		

[a] According to Modified BG Prasad Scale, May' 2021 where CPI-IW for May' 2021 was 119.6.

4. Discussion

The present study showed that 62.2% of the study population were underweight according to BMI criteria. Similar study done by Mollah A et al[12] in 2018 at Burdwan municipality among 113 adult TB patients revealed that 61.9% of the study subjects were underweight. In a cohort study done by Bhargava A et al[4] in rural central India during 2004–2009 among 1695 adult TB patients showed that more than 85% of men and

Table 2 – Multivariable logistic regression showing predictors of adherence among the study subjects (n = 82).

Background characteristics	Total No (%)	Adherence		Statistical test	
		Non-adherent No (%)	Adherent No (%)	OR (95% CI)	AOR (95% CI)
Age (in years)					
≤45	32 (39)	16 (50)	16 (50)	1	1
>45	50 (61)	15 (30)	35 (70)	2.333 (0.930–5.854)	3.686 (1.147–11.842)[b]
Gender					
Male	65 (79.3)	25 (38.5)	40 (61.5)	1	1
Female	17 (20.7)	6 (35.3)	11 (64.7)	1.146 (0.376–3.488)	1.080 (0.253–4.617)
Illiterate	36 (43.9)	11 (30.6)	25 (69.4)	1	1
Literate	46 (56.1)	20 (43.5)	26 (56.5)	0.572 (0.228–1.432)	0.542 (0.180–1.633)
Occupation					
Employed	28 (34.1)	12 (42.9)	16 (57.1)	1	1
Unemployed	54 (65.9)	19 (35.2)	35 (64.8)	1.382 (0.543–3.515)	1.057 (0.347–3.217)
SES[a]					
Upper + Upper middle + Middle	24 (29.3)	9 (37.5)	15 (62.5)	1	1
Lower middle + Lower	58 (70.7)	22 (37.9)	36 (62.1)	0.982 (0.368–2.621)	1.188 (0.389–3.625)
Past h/o alcoholism					
No	51 (62.2)	18 (35.3)	33 (64.7)	1	1
Yes	31 (37.8)	13 (41.9)	18 (58.1)	0.755 (0.302–1.887)	0.861 (0.272–2.722)
Clinical type of TB					
Pulmonary	71 (86.6)	29 (40.8)	42 (59.2)	1	1
Extra-pulmonary	11 (13.4)	2 (18.2)	9 (81.8)	3.107 (0.625–15.445)	8.539 (1.305–55.871)[b]

[a] According to Modified BG Prasad Scale, May' 2021 where CPI-IW for May' 2021 was 119.6.
[b] p value ≤ 0.05 Nagelkerke R^2 value: 0.173 Hosmer and Lemeshow test (p value): 0.999.

almost 95% of women were underweight and two-thirds of women and half of men were severely underweight. In this study we found that 66.2% men and 47.1% women were underweight and 44.2% men and 12.5% women were severely underweight which was not similar to the above study findings which could be because of large sample size in the cohort study. Another study done by R. Zachariah et al[5] in Thyolo district, a rural area in Malawi during 1999–2001, among 1181 TB patients showed that 57% study subjects were malnourished, and among them mild malnutrition was 22%, moderate 14%, severe malnutrition was 21%. In our study it was noted that underweight was 62.2% which was comparable to the above study but mild, moderate and severe underweight was 35.3%, 25.5% and 39.2% respectively which differed from the above findings. This could be because of different study setting and large sample size.

As far as the level of adherence was concerned, our study revealed only 10 (12.2%) study subjects had low level of adherence, medium in 21 (25.6%) and high in 51 (62.2%) study subjects using MMAS (8-Item). In a study done by Orooj M et al[13] in a tertiary DOT center, India from 2019 to 2020 by online interviewing 250 adult TB patients during Covid-19 pandemic, showed that 60% of the study subjects had low/poor medication adherence and 40% had medium to high adherence which was not similar to our study. Covid pandemic depression could be one reason for such poor adherence. Again, in a cross-sectional study in rural Shandong province, China done by Minlan Xu et al[14] among 358 adult TB patients showed that 34.64% of the study subjects had low medication adherence and 65.36% had medium/high adherence. Women, older age group, low education, and living without a partner had higher percentage of low medication adherence which was not statistically significant. But in our study, patients who were more than 45 years and suffered from extra pulmonary TB were more adherent to treatment and this finding was statistically significant. In another study done by AA Gube et al[15] in southern Ethiopia, 2017 among 271 TB patients showed that overall adherence was 75.3% and non-adherence was 24.7% which was not similar with our study.

5. Conclusion

Our study revealed that nearly two-thirds of the rural TB patients were underweight with one third of them being severely underweight. Thus poor nutritional status was highly prevalent co-morbidity associated with TB in rural population. Emphasis on diet should be given and family members should be made aware about the need for proper nutrition to the patients. We found that 62% of the study subjects were adherent to treatment and 38% of them were non adherent. Health education, awareness and more vigilant monitoring is still needed so that TB patients can be cured successfully.

5.1. *Limitations*

In order to comment on the nutritional status of the patient, dietary survey could have been an alternative option which was not done in this study. Similarly, NPY and DBT scheme, which could be traced from NIKSHAY portal of the district under the NTEP, was also not assessed in this study. As far as adherence to treatment is concerned, firstly, to explore the factors related to adherence, a longitudinal study could be done. Secondly, it is very difficult to measure medication adherence because adherence is an individual patient behavior. There are several methods for measurement of medication adherence as shown in a study done by Brown M T[15]. In our study only subjective measurements were considered because of feasibility of the researcher. Other methods could be implemented to support this study finding.

Conflicts of interest

The authors have none to declare.

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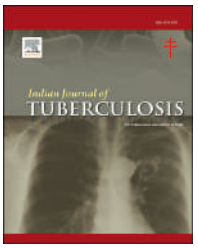

Original article

Quality of life among tuberculosis patients on treatment in Southwest Nigeria

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ABSTRACT

Background: Tuberculosis is still a major public health concern that affects millions of people worldwide. Despite the fact that tuberculosis has a well-established treatment, little attention is paid to the quality of life of TB patients on treatment. Poor quality of life has been linked to lower treatment adherence in patients having TB. As a result, the purpose of this study was to evaluate the quality of life of tuberculosis patients and its associated factors.

Methods: The study was a cross-sectional study conducted in Southwest Nigeria among drug-susceptible tuberculosis patients between February and September 2020. The World Health Organization Quality of Life Brief version questionnaire was used to collect data on quality of life (WHOQOL-BREF). A total of 330 people were approached. SPSS version 20 was used to analyze the data. The descriptive data was analyzed using means, standard deviations, and proportions, while the Chi-Square test and binary logistic regression were used to assess the association between variables. $P < 0.05$ was used to determine statistical significance.

Results: The respondents' average age was 35.50 ± 11.59 years and most of the respondents (67.9%) were males. The overall mean quality of life was good (4.01 ± 0.529) with the highest score (66.47 ± 10.50) in the environmental domain and the least score (62.88 ± 15.36) in the social domain. There was an association between good quality of life and the patient's length of illness prior to diagnosis (AOR = 0.468, 95% CI = 0.225–0.973).

Conclusion: In line with this study, the overall quality of life of drug-susceptible tuberculosis patients is good and is related to the duration of illness before the diagnosis of tuberculosis was made. Therefore, more efforts should be made to increase awareness of tuberculosis and intensify active case finding to enhance early case detection and a better quality of life.

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1. Introduction

Over 1.3 million people died as a result of tuberculosis (TB) worldwide in 2020. 1.3 million of these deaths happened in people without the Human Immunodeficiency Virus (HIV), while 214,000 happened in people who had HIV.[1] Without treatment, tuberculosis has a high mortality rate. However, prompt and timely treatment reduces the risk of disease-related death.[2]

One of the 30 nations with the highest rates of tuberculosis is Nigeria. In 2015, there were 322 TB cases for per 100,000 individuals in Nigeria. However, only 15% of the nation's overall disease burden was reported.[3] It has been estimated that Nigeria has about 564,460 new cases of tuberculosis occurring annually.[4] A tuberculosis prevalence survey done in Nigeria in 2012 showed that Nigeria has a crude prevalence rate of 348/100,000 population for bacteriologically confirmed cases. The Southwest zone has the highest prevalence of tuberculosis in Nigeria, accounting for 44% of these cases.[5]

Adequate treatment of tuberculosis patients is a highly important step in the global control of tuberculosis. However, it is essential to note that in addition to having clinical symptoms (such as cough, difficulty in breathing, weight loss, weakness, and so on). TB patients also have several physiological, financial, and psychological needs.[6] Furthermore, some patients have to suffer adverse reactions as a result of the management of the disease and clinical symptoms due to lung and other organ damage which often extend beyond the duration of treatment. All these issues relating to the disease and its management affect the overall well-being of the patient and the burden of these factors may equal or even exceed the physical effect of the illness.[6]

As a result, the quality of life of the tuberculosis patient may be affected. Quality of life (QOL) has been described as an individual's perception of wellbeing in physical, mental, and social aspects.[7] Quality of life is a complex, broad, and multidimensional concept that encompasses an individual's physical, mental, and social health. Measuring 'quality of life' can be difficult because the term has different meanings for each academic discipline, individual, and group.[8] Despite this, researchers have developed tools to help conceptualize and measure the various domains of quality of life, as well as how they relate to one another.[8] The extent to which disease and its treatment affect a patient's subjective evaluation of their daily level of physical, mental, and social well-being is defined as health-related quality of life.[9]

In recent years, there has been an increase in assessing and improving the quality of life of patients with chronic diseases.[10] In addition to their physical health, patients with chronic diseases place a high value on their mental and social well-being.[9] Furthermore, health care providers have realized that focusing solely on the physical aspects of the disease is insufficient, and that the best and most effective treatment for the patient should be tailored to help patients live a normal life.[11] As a result, assessing health-related quality of life is now an important health outcome and a focus for policymakers, health-care professionals, and researchers.[9]

Over the years, considerable attention has been focused on the prevention of the transmission and the outcome of patients who are treated for tuberculosis. However, their quality of life has received little attention.[12] Tuberculosis patients, despite being on treatment, may have a poor quality of life because of the disease or adverse reactions as a result of the drugs used in disease management. These may have an impact on the daily activities of TB patients, and alter their states physically and mentally. As a result, the treatment outcome of the patients may suffer.[13]

In Nigeria, very few studies on the quality of life of tuberculosis patients have been conducted. Knowledge of the factors that affect the quality of life of tuberculosis patients will be beneficial in planning how best to manage tuberculosis patients who are on treatment. This will more likely result in a greater number of patients completing their medications as prescribed and having good treatment outcomes at the end of their treatment. It will also take us a step further in achieving the current global agenda to end tuberculosis.

This study was therefore conducted in Nigeria's Southwest geopolitical zone, which has the highest burden of tuberculosis in the country, to assess the quality of life of tuberculosis patients and to determine its associated factors.

2. Methods

The study was conducted in Southwest Nigeria, with latitude and longitude coordinates as 7°27′57.60N and 4°33′57.60E between February and September 2020. Six states make up the southwest zone: Ekiti, Lagos, Ogun, Ondo, Osun, and Oyo. Geographically, the region is located on the tropical belt, with Kogi State to the north, Edo State to the east, the Republic of Benin to the west, and the Atlantic Ocean to the south. The projected population of the southwest region was 38,257,260 in 2016. All Local Government Areas within the southwest region have DOTs facilities for the management of drug-susceptible tuberculosis patients.[14]

2.1. *Study design, study population, and sample size determination*

The research involved a descriptive cross-sectional study of drug-susceptible tuberculosis patients receiving treatment in southwest Nigeria. All adult patients aged 15 years and above who were diagnosed either bacteriologically using sputum smear or MTB/RIF Assay test were recruited for the study. Patients who were critically ill were not allowed to participate in the study. The Cochrane formula was used to calculate the sample size.[15]

$n = z^2 * \sigma^2$ divided by E^2

where n is the required sample size.

$Z = z$ statistic at 5% level of significance (1.96)

Based on a previous study, the mean ± SD of QOL of tuberculosis patients was 64.63 ± 16.14.[16]

σ = standard deviation.

E = margin error when the marginal error is taken into account when estimating the mean 64.63 ≈ 64 to be ±2,

A sample size of

$n = 1.96^2 * 16^2$ divided by $2^2 = 249.6 \approx 250$

Non response (20%) = 50

Therefore, n = 330

2.2. Sampling technique and study instrument

Participants were chosen using the multistage sampling technique. In the first stage, a simple random sampling method was used to select two states from the six states in Nigeria's Southwest region. The states of Ogun and Oyo were chosen. In stage 2, one senatorial district in each of the selected states was chosen using simple random sampling. Ogun Central Senatorial District was selected from Ogun state while Oyo South senatorial district was selected from Oyo state. In stage 3, a list of DOTs facilities in each selected senatorial district was obtained for the two states. In each state, DOTs facilities were picked proportional to the numerical size of TB patients diagnosed during the preceding quarter. The participants were chosen using systematic random sampling in the final stage.

An interviewer-administered semi-structured questionnaire adopted from the World Health Organization Quality of Life BREF (WHOQOL BREF) tool was used to collect data.[17] The questionnaire also requested information on socio-demographic characteristics such as age, gender, educational status, employment status, religion, income estimates, and behavioral history (alcohol use, smoking). The questionnaire was pre-tested on 40 drug-susceptible patients in Ondo State, which is in the same geopolitical zone as the selected states and has similar socio-demographic characteristics.

2.3. Data management

2.3.1. Measurement of variables

The quality of life of TB patients on treatment was the dependent variable/primary outcome, while the independent variables were demographic, socio-economic variables, social support, clinical characteristics, and treatment-related factors. The WHOQOL BREF's 26 questions were used to assess quality of life. Two questions assessed general health and overall quality of life. The remaining 24 questions assessed the quality of health across four domains: physical health, psychological health, social relationships, and the environment.

Answers to seven items were used to assess the physical health domain. This domain included daily activities, reliance on medicinal substances and medical aid, energy and fatigue, mobility, pain and discomfort, sleep and rest, and work capacity. Six items were used to assess the psychological health domain. Thinking, learning, memory and concentrations were all assessed, along with body image, appearance, negative and positive emotions, self-esteem, spirituality and personal convictions. Items used to assess the social relationship domain were three. Personal relationships, social supports, and sexual activities were all evaluated in this domain. Responses to eight items were used to assess the environment domain. The domain evaluated financial resources, freedom/physical safety/security, accessibility and quality of health and social care, the home environment, opportunities for learning new knowledge and skills, participation in and access to recreational activities, the physical environment, and transportation.

Domain scores were scaled from 1 to 5, with 5 being the most optimistic response. The higher the scores, the higher the quality of life.[18] For consistency of results, the raw score of each domain was converted into a standardized score ranging from 0-100,[17,19] with higher scores corresponding with higher quality of life. According to the WHO BREF guidelines, a low quality of life score was defined as a raw score of 21 or less in domain 1, an 18 or less in domain 2, a 9 or less in domain 3, and a 24 or less in domain 4. In all domains, these scores translate to a transformed score of 50 or less.[20]

2.4. Statistical analyses

The questionnaires were cleaned and cross-checked for errors. The collected data was entered into IBM SPSS Statistics for Windows, Version 20, for analysis and statistical calculations. Tables and charts were used to present the analyzed data. Means, standard deviations, and proportions were used to summarize the data. The primary outcome variable (quality of life) was quantitative (mean ± standard deviation). However, the primary outcome variable was categorize in the subsequent analysis, and the Chi-square test was used to compare categorical variables (such as demographics, socio-economic, clinical, and treatment-related variables). Backward elimination logistic regression was used in multivariate analysis to identify factors associated with quality of life. The level of significance was set at 0.05 with a 95% confidence interval. However, a p-value of up to 0.2 from the bivariate analysis was included in the logistic regression model for further analysis.

2.5. Ethical approval

The Health Research and Ethics Committee of Olabisi Onabanjo University Teaching Hospital Sagamu, Ogun State, Nigeria (NHREC November 28, 2017) approved this study. The approval of the Ministry of Health in the two selected states was also sought (Oyo and Ogun State). Furthermore, permission was obtained from the heads of the facilities used for the study. Before administering the questionnaires, each participant provided informed consent.

3. Results

A total number of 330 drug-susceptible respondents were a part of this study. There was a 100% response rate. The response rate was 100%. The socio-demographic details of respondents are displayed in Table 1. The highest number of responders were aged 21–30 years (mean = 35.50 ± 11.585). The majority (83%) were Yoruba and over half were Christians (53.6%) with only a few respondents (2.7%) practicing traditional religion. A little less than half (48.8%) of those polled had a secondary education. A total of 76.4% of the respondents

Table 1 – Socio-demographic characteristics of respondents.

Variable	Drug-susceptible n (%) N = 330
Age	
≤20	31 (9.4)
21–30	99 (30.0)
31–40	91 (27.6)
41–50	65 (19.7)
>50	44 (13.3)
Mean age =	35.50 ± 11.585
Sex	
Male	224 (67.9)
Female	106 (32.1)
Marital status	
Married	209 (63.3)
Single	107 (32.4)
Separated	7 (2.2)
Widow/widower	4 (1.2)
Divorced	3 (0.9)
Family type	
Monogamous	232 (70.3)
Polygamous	98 (29.7)
Family size	
≤4	118 (35.8)
5–6	107 (32.4)
≥7	105 (31.8)
Mean family size =	5.81 ± 2.901
Tribe	
Yoruba	274 (83.0)
Igbo	37 (11.2)
Hausa	17 (5.2)
Others	2 (0.6)
Religion	
Christianity	177 (53.6)
Islam	140 (42.4)
Traditional religion	9 (2.7)
Others	4 (1.3)
Educational Level	
No formal education	19 (5.8)
Primary	70 (21.2)
Secondary	161 (48.8)
Tertiary	80 (24.2)
Current employment status	
Employed	252 (76.4)
Unemployed	78 (23.6)
HIV status	
Negative	304 (92.1)
Positive	26 (7.9)
Currently smoke cigarettes	
Yes	9 (2.7)
No	321 (97.3)
Currently drink alcohol	
Yes	12 (3.6)
No	318 (96.4)
Currently use illegal drugs	
Yes	6 (1.8)
No	324 (98.2)
Sickness (weeks) before diagnosis	
≤4	218 (66.1)
>4	112 (33.9)
Comorbidities present	
Yes	35 (10.6)
No	295 (89.4)

were currently employed and only 7.9% were HIV positive. Table 2 displays the respondents' mean quality of life score. The mean overall quality of life was 4.01 ± 0.53 while the mean general health satisfaction was 4.03 ± 0.71. The environmental domain had the highest mean score (66.47 ± 10.50) while the social domain had the least scores (62.88 ± 15.36).

Table 3 displays the quality of life scores among the respondents, which is classified as good or poor. The physical and environmental domains had the highest proportion of respondents reporting a high quality of life (91.5% each), while the psychological domain had the lowest (76.4%). Overall, 89.7% of respondents had good quality of life.

Table 4 depicts the relationship between socio-demographic factors and respondents' overall quality of life. Multivariate analysis revealed an association between the duration of illness prior to the diagnosis of tuberculosis and a good overall quality of life (AOR = 0.468; 95% CI = 0.225–0.973).

4. Discussion

According to this study's findings, the quality of life among drug-susceptible tuberculosis patients is good, with the highest score in the environmental domain. This finding is similar to one reported in a study conducted in Lagos, Southwest Nigeria, where the environmental domain had the highest mean score of 56.03 ± 13.59.[21] The finding, however, differs from that reported in Saudi Arabia, where the social domain had the highest mean score of 65.23 ± 7.90.[22] The similarity with the study done in Lagos State could be ascribed to the fact that the state is in the same geopolitical zone as our study area and shares certain similarities in terms of economy, cultural heritage, access to health care, and transport services.

The social domain had the least score in this study with a mean score of 62.88 ± 15.36. This finding corroborated findings from a study conducted in Ilorin, Nigeria (47.00)[23] but differs from what was reported in Saudi Arabia where the physical domain had the least score (54.65 ± 5.29).[21] This lends a voice to the need for strengthening public awareness in the context of reducing inter-personal stigmatization and also improving health care packages for drug-sensitive tuberculosis patients. Stigmatization is an important social determinant of health commonly experienced by tuberculosis patients from family members and other members of the public mainly because of the fear of infection.[24,25] TB patients who experience stigmatization often become shameful, guilty of their status, and subsequently become withdrawn from well-established social

Table 2 – Mean quality of life score of respondents.

Domain	Drug-susceptible N = 330 mean ± SD
Overall QOL	4.01 ± 0.53
Satisfaction with General Health	4.03 ± 0.71
Physical	65.59 ± 10.89
Psychological	63.60 ± 9.34
Social	62.88 ± 15.36
Environment	66.47 ± 10.50

Table 3 – Quality of life scores in drug-susceptible tuberculosis patients categorized into good and poor.

Domain	Quality of Life category	Drug-susceptible N = 330
Overall	Good	296 (89.7)
	Poor	34 (10.3)
General Health	Good	286 (86.7)
	Poor	44 (13.3)
Physical	Good	302 (91.5)
	Poor	28 (8.5)
Psychological	Good	294 (89.1)
	Poor	36 (10.9)
Social	Good	252 (76.4)
	Poor	78 (23.6)
Environmental	Good	302 (91.5)
	Poor	28 (8.5)

relationships including sexual relationships.[26,27] This could explain why the social domain in this study had the lowest mean score using the WHOQOL BREF tool, which assesses personal relationships satisfaction, sex life, and social support had the least mean score in this current study. In addition, drug-susceptible tuberculosis patients on treatment do not receive any form of financial support from the National Tuberculosis Programme all through the duration of their treatment unlike their drug-resistant counterparts thereby making them feel marginalized by the national system of health care.

The mean overall quality of life score for drug-susceptible respondents in this study was 4.01 ± 0.53. This was lower than 4.28 ± 0.06 reported in Saudi Arabia[22] but higher than 3.40 ± 0.93 reported in Lagos Nigeria.[21] The lower overall quality of life score in Nigeria compared to Saudi Arabia may be due to the better socioeconomic, access to the health care system, and social safety nets available in Saudi Arabia.[28]

The length of time before TB was diagnosed was the most significant factor associated with quality of life among TB patients in this study. TB patients who had been sick for less than 4 weeks before diagnosis had a significantly better overall quality of life score. This finding contradicts previous research, which found no link between the length of illness before diagnosis and overall quality of life.[20–22] The difference in the finding from this study and what was found in a place

Table 4 – Association between socio-demographic factors and overall quality of life (QOL) among drug-susceptible patients on treatment.

Variable	Poor QOL N = 34	Good QOL N = 296	Adjusted odd ratio (95% confidence interval)
Sex			
Male	27 (79.4)	195 (65.9)	1
Female	7 (20.6)	101 (34.1)	1.757 (0.723–4.272)
COR (95% CI)	1.909 (0.212–17.292)		
Marital status			
Married	24 (70.6)	185 (62.5)	1
Others	10 (29.4)	111 (37.5)	0.930 (0.414–2.087)
COR (95%CI)	1.440 (0.664–3.124)		
Family size			
≤6	26 (76.5)	199 (67.2)	1
>6	8 (23.5)	97 (32.8)	1.773 (0.746–4.210)
COR (95% CI)	1.584 (0.692–3.628)		
Religion			
Christianity	14 (41.2)	163 (55.1)	1
Others	20 (58.8)	133 (44.9)	0.552 (0.259–1.176)
COR (95% CI)	0.571 (0.278–1.174)		
Currently smoke cigarettes			
Yes	0 (0.0)	9 (3.0)	1
No	34 (100.0)	287 (97.0)	0.000 (0.000)
COR (95% CI)	1.118 (1.077–1.161)		
Currently drink alcohol			
Yes	0 (0.0)	12 (4.1)	1
No	34 (100.0)	284 (95.9)	0.000 (0.000)
COR (95% CI)	1.120 (1.078–1.163)		
Currently use illegal drugs			
Yes	0 (0.0)	6 (2.0)	1
No	34 (100.0)	290 (98.0)	0.000 (0.000)
COR (95% CI)	1.117 (1.076–1.160)		
Sickness (weeks) before diagnosis			
≤4	17 (50.0)	200 (67.6)	1
>4	17 (50.0)	96 (32.4)	0.468 (0.225–0.973)[a]
COR (95% CI)	0.480 (0.235–0.981)		
Comorbidities present			
Yes	2 (5.9)	33 (11.1)	1
No	32 (94.1)	263 (88.9)	0.685 (0.149–3.152)

[a] Statistically significant.

like Saudi Arabia[22] could be because Saudi Arabia has a better social health insurance system which enables her citizens to present earlier compared to Nigeria where many patients do not present on time because of lack of financial capacity to provide out of pocket payment for health care services.[28]

Despite the study's findings, it has some limitations, one of which is that it was a cross-sectional study, so it was impossible to assess whether the patients' quality of life improved or worsened over time. Further research should be conducted using a longitudinal approach to assess these patients' quality of life at various intervals to see if it improves with additional treatment.

5. Conclusion

In this study, the overall quality of life among drug-susceptible tuberculosis patients was good, with the environmental domain scoring the highest and the social domain scoring the lowest. The length of illness before diagnosis was the only significant factor associated with overall quality of life. Improving community awareness and early access to the system of health care through expansion of the National health insurance scheme may encourage early diagnosis and subsequent treatment of tuberculosis patients. This would improve early presentation and diagnosis, resulting in a higher quality of life.

Conflicts of interest

The authors have none to declare.

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Original article

Involving religious organizations in improving TB medication adherence

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ABSTRACT

Background: Health is a state of health, both physically, mentally, spiritually, and socially that allows everyone to live a productive life socially and economically. Pulmonary tuberculosis is a global health problem that could impact on productivity and quality of life. The number of TB cases in Indonesia According to WHO, there are an estimated 1,020,000 new TB cases per year (399 per 100,000 population) with 100,000 deaths per year (41 per 100,000 population). Pulmonary tuberculosis is a global health problem that can impact productivity and quality of life. The persistence of family support in improving the compliance of pulmonary tuberculosis patients in taking medication is the key to the success of tuberculosis treatment.

Aims: This study aims to determine the involvement of religious organizations in supporting tuberculosis patients to improve treatment adherence.

Methods: This research is a qualitative study with a phenomenological approach. Data were collected using in-depth interviews and then analyzed by content analysis. The informants in this study consisted of 8 participants.

Result: The results of this study found three themes, namely Understanding TB treatment, Socialinteraction management, and Socialsupport.

Conclusions: It was concluded that the support of religious organizations during the patient's treatment can increase the patient's compliance to take medicine regularly and make regular controls/visits. It is also recommended that families encourage patients to continue to participate in religious activities while still complying with health procedures.

1. Introduction

Tuberculosis is a disease caused by the Mycobacterium germ and is still a high burden disease for Indonesia. The increasing burden of TB is caused by poverty, failure of TB activities that have been caused by inadequate political commitment and funding, unavailability of services in the community leading to reduced problem innovation and inappropriate diagnosis, reduced supply of drugs and reduced reporting of tuberculosis patients, lack of surveillance, lack of discourse on case recording and reporting, treatment management and unreported movement of people.[1] TB is one of the top 10 causes of death and the leading infectious agent worldwide. In 2017, the number of TB cases in Indonesia according to WHO, there were an estimated 1,020,000 new TB cases per year (399 per 100,000 population) with 100,000 deaths per year (41 per

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100,000 population). An estimated 78,000 HIV-positive TB cases (10 per 100,000 population), mortality 26,000. The total number of cases was 324,539, of which 314,965 were new cases. The number of TB-RO cases is estimated at 10,000 cases, which comes from 1.9% of TB-RO cases from new TB cases, there are 12% of TB-RO cases from TB with re-treatment and the proportion of TB cases based on age groups is mostly in the age of 25–34 years with 19.50% of cases.[2]

The World TB Control Program aims to reduce the burden of TB and realize a healthy and TB-free global, WHO has created a new strategy that accompanies the SDGs under the name End TB Strategy.[3] The principles of the strategy used by WHO are to include the role of government in evaluating and monitoring the course of this management art; Utilize coalitions with existing social and community organizations; ensure the protection of human rights and promote equality between citizens; Adapt tactics and targets in each country, with worldwide cooperation. Various programs, methods and approaches have been carried out by the government including supervised drug swallowing (PMO) programs, door knocking events, find treat until cure (TOSS) events.

DOTS has been recommended to ensure drug adherence and requires trained health care workers or treatment supporters to observe daily drug consumption.[4–6] According to the 2016[7] of TB prevention, namely the implementation of TB prevention needs to be supported by sharing efforts and strengthening coordination procedures, as well as partnerships between TB program managers with cross-sector and cross-program government agencies, stakeholders, health insurance as well as using community organizations. According to the 2018 North Sumatra Rakerkesda there were 73,488 TB patients (6.5%) from the total number of Indonesian TB patients, namely 1,020,000 TB cases. Of the 73,488 TB patients in North Sumatra, 34,898 people were found (March 2018). Poly factors that influence the success of TB treatment include adherence, education, perceptions, socio-economic status of sufferers, health workers at the health center.[8–10]

The proportion of TB patients taking routine medication for less than 6 months in the Serdang Bedagai region amounted to 48.87% or lower than North Sumatra Province (72.6%). The reasons why people with TB do not routinely take medication are most often drugs not available in health facilities using a percentage of 5.00%, often forgetting 6.54%, not being able to buy TB drugs regularly 12.4%, not regularly taking treatment 27.28% and so on such as not being able to stand the side effects, the treatment period feels outdated and already feels healthy.

Whether or not a cure is achieved is caused by irregularity or non-adherence to treatment so that efforts to improve treatment adherence mean a priority dilemma in pulmonary TB control programs.[11–15] Knowledge factors have a significant effect on the regularity of taking medication for TB patients.[13] Psycho-emotional (PE) and socio-economic (SE) interventions provided to TB patients and to assess the effect of this hegemony on medication adherence and treatment.[16,17] Education and counseling: It is noted by Refs. [18–20] that having knowledge about TB disease is also a facilitator of TB treatment adherence. Studies have shown that peer counseling is associated with higher self-esteem and a sense of mastery, characteristics that in turn are associated with lung[21] and latent TB treatment completion.[22,23] The proportion of TB patients taking routine medication for less than 6 months in the Serdang Bedagai region amounted to 48.87% or lower than North Sumatra Province (72.6%). The reasons why people with TB do not routinely take medication are most often drugs not available in health facilities using a percentage of 5.00%, often forgetting 6.54%, not being able to buy TB drugs regularly 12.4%, not regularly taking treatment 27.28% and so on such as not being able to stand the side effects, the treatment period feels outdated and already feels healthy.

Religious organization is an external motivation that can be used to improve the compliance of tuberculosis patients. People in general are identical to obey and follow instructions or suggestions given by religious organizations such as wiritan and church events. Motivation and advice given through religious activities can trigger and activate tuberculosis patients to comply during their treatment.

This study aims to explore the involvement of religious organizations in improving the compliance of tuberculosis patients to take tuberculosis medication regularly.

2. Methods

This research was conducted in the working area of the Serdang Bedagai Health Office in 2022. This study used a qualitative approach with data analysis techniques using qualitative content analysis. Data collection using in-depth interviews. The sampling technique used purposive sampling. There were 8 informants consisting of 4 people with tuberculosis and 4 people from religious organizations.

The researcher first produced an outline of the subject matter to be conveyed to the informant in the form of an interview guideline. The interview questions addressed to the subjects were open-ended and did not lead personally to the research questions. The process of data collection through interviews was conducted using a voice recorder. Recording was done with the subject's consent. The results of the interviews in the form of voice recordings were then converted into written form (transcripts).

The designed transcripts were analyzed using qualitative content analysis. Qualitative content analysis is carried out using the Atlas program by describing or filtering text or word terms into a number of categories that represent a variety of specific content. The results of content analysis are a method for analyzing text content flexibly. The qualitative results of content analysis can be used to evaluate the findings resulting from the analysis itself.

3. Result

This study used 8 participants from 4 people with tuberculosis and 4 people from religious organizations. Details can be seen in the following demographic data.

3.1. *Understanding of TB treatment*

Providing information about health services, especially tuberculosis, needs to be improved. Religious organizations

can provide advice and provide examples of others who have been affected by tuberculosis and recovered while adhering to treatment.

3.1.1. How to deal with drug side effects

Drug side effects are the most common complaints of people with tuberculosis. Nausea, vomiting, dizziness, dizziness, weakness and even changes in the color of urine often prevent patients from adhering to their treatment. These side effects are often not understood by the patient so that when they occur, the patient immediately stops the treatment.

> *"... When I drank it, I was nauseous for a long time, sir ... nauseous ... up from here, right, and then I wanted to vomit but there was nothing to vomit, sir, even cold sweat ..." (P1; P3; P5)*

> *"... If the red medicine is not a problem, sir, it's just that I get hungry easily, so I just want to eat ..." (P2; P3)*

> *"... It's just that I immediately want to feel nauseous, like I want to vomit, I don't think if I vomit my stomach will feel better but I don't want to vomit, so my stomach hurts and then my head staggers ..." (P1; P2; P3)*

> *"... Indeed, taking TB medication always has an effect, but we also have to be strong and remain obedient to taking the medicine so that we can recover quickly and not infect other people including family ..." (P5; P6; P7; P8)*

3.1.2. Treatment discipline

Discipline in treatment is one of the keys to healing TB patients. As is known, TB treatment requires a long time and months of treatment. It takes discipline in treatment to produce a cure from TB disease.

> *"... For the red color yesterday, I drank it 3 times a day and I took it in the morning before breakfast, one hour before breakfast ..." (P1; P3)*

> *"... I take the medicine after dinner sir because it's good not to feel sick or nauseous sir ..." (P2; P4)*

> *"... The red medicine I take 3 packs every night before going to bed, and this yellow one I also take 3 packs before going to bed too ..." (P2; P3; P4)*

> *"... Remaining obedient is the key to treatment, God willing, if it is persevered and intended to heal, it will definitely heal ..." (P6; P7)*

3.1.3. Stigma

Stigma is the negative view of the community or family towards people with tuberculosis. Stigma often triggers the noncompliance of tuberculosis patients in treatment. This stigma is immediately stamped on tuberculosis patients once they are diagnosed with tuberculosis. The long treatment and the fear of infecting others eventually lead tuberculosis patients to be shunned by their surroundings (Table 1 and Table 2).

> *"... When we go for treatment, sir, we are immediately shunned, it seems like we can't get close to the sick, sometimes we become sad, it hurts sir to be made like that ..." (P1; P2; P3)*

> *"... You immediately felt insecure when you were told by the puskesmas, because you looked at the goggles and they said it was nuler, so you felt insecure, sir ..." (P1; P2; P4)*

> *"... Often these TB people are immediately shunned sir, but I said don't let them get discouraged and not want to seek treatment again ..." (P5; P6; P7)*

> *"... Remaining obedient is the key to treatment, God willing, if it is pursued and intended to recover, it will definitely recover ..." (P6; P7)*

3.2. Social interaction management

In this theme there are two sub-themes, namely community interaction activities and family interaction activities. The government program seeks to eliminate TB by 2030 with the motto TB Free starting with us.

3.2.1. Community interaction activities

This is the activity of tuberculosis patients in interacting with the community. Tuberculosis patients often do not comply with health programs such as wearing masks or disposing of sputum properly. Most tuberculosis patients dispose of sputum carelessly and do not use masks when interacting in the social environment of the community. This can have an impact on the spread of tuberculosis germs.

Table 1 – Informant demographic data.

Participants	Gender	Age (Years)	Education	Occupation
P_1	Male	35	Junior High School	Enterpreneur
P_2	Female	40	Junior High School	Housewife
P_3	Female	38	Junior High School	Housewife
P_4	Male	40	Senior High School	Private employee
P_5	Male	36	Senior High School	Enterpreneur
P_6	Female	50	Elementary School	Housewife
P_7	Female	44	Elementary School	Private employee
P_8	Female	38	Elementary School	Housewife

The results of the analysis and verbatim transcripts found 3 themes and 7 category. The details can be seen in Table 2.

Table 2 – Theme and category

Theme	Category
Understanding of TB treatment	1. How to deal with drug side effects 2. Medication discipline 3. Stigma
Social interaction management	1. Community interaction activities 2. Family interaction activities
Social support	1. Information support 2. Appreciation support

"... It's good if there is no tightness, TB patients should just be obliged to participate in every activity such as wiritan or community service ..." (P1; P2; P3)

"... They (people with TB) should be aware that they carry TB germs so it's good for them to keep their distance when interacting and cover their mouths with a mask when coughing ..." (P7; P8)

"... In our wiritan, there are also those who have been sick like you sir, but they have recovered so they have joined again sir, that's why I told them that they have recovered quickly so they can join again ..." (P7; P8)

"We suggest that if you want to worship at the church, please but you must still wear a mask and don't forget to keep taking the medicine, because if you regularly take the medicine, hopefully you won't infect other people again ..." (P5; P6)

3.2.2. *Family interaction activities*

Family interaction activities are the most recognized by people with tuberculosis. This is due to the close contact of tuberculosis patients with other family members, which can lead to transmission and impact the family system.

"... It's like that sir ... the cup, plate and glass must be played with, not allowed to be close to other families. If I usually go straight to the room, sir ... later my mother will remind me to take medicine when I go to bed, sir. One more thing, sir ... towels should not be the same, sir ..." (P1; P2; P3; P4)

"... If you are told from here (puskemas) that the family has TB, the family's habit is not to participate in all family activities ..." (P1; P2; P3; P4)

"... If possible, those who have TB should not be separated, sir, for example, they should be immediately isolated, because they feel sorry for them, but they are still told to continue taking their medicine, and yes ... keep wearing a mask, and then just differentiate the plates and glasses ..." (P5; P6)

"... We always remember that people with TB are not shunned but supported, accompanied, helped so that they are diligent in taking their medicine ..." (P7; P8)

3.3. *Social support*

This theme has two sub-themes, namely information support and appreciation support for tuberculosis patients during treatment. Family efforts to cure sick family members must provide maximum support to the patient. Patients with tuberculosis generally experience prolonged coughing and shortness of breath which makes it difficult for patients to fulfill their own needs. Family support is needed for the patient while he/she is undergoing treatment. Patients with tuberculosis cannot be left alone but must still be assisted and facilitated both in terms of nutrition, daily needs, financial needs such as costs for travel expenses when making controls or re-visits to the health center.

3.3.1. *Information support*

Information support is support that tuberculosis patients can receive about the disease they are currently experiencing. Starting from treatment, prevention to recovery. All this information is very useful and needed by patients so that they do not feel bored and burdened with long treatment times and taking medicine every day.

"... It would be good if the head of the neighborhood, people from the neighborhood or the church participated in providing input and advice when there was a meeting ..." (P5; P6; P7; P8)

"... As the head of the neighborhood, we often remind people who have TB to be obedient to treatment and then we also ask what can be helped, so sir ..." (P5; P7)

"... Sometimes when we are at the wiritan event, we still invite them to join sir, but with the condition that they must wear a mask sir, then we tell them not to stop taking their medicine, so they will be more enthusiastic sir ..." (P6)

"... We from the church also have social visits sir, so when we visit we still encourage, we also help with eggs sir, we still pray for a speedy recovery sir, can join the church again ..." (P8)

3.3.2. *Appreciation support*

When a person is affected by tuberculosis, the average patient immediately feels isolated and away from community activities. For this reason, visits from relatives, the community, religious organizations are needed to keep the patient enthusiastic about undergoing treatment.

"... Sometimes relatives also come to visit bang, give encouragement, give advice, yes ... be grateful brother ..." (P1; P4)

"... Like yesterday's Eid, it was my brother and sister who came ... sad, sir. they still encourage me, tell me to be strong, get regular treatment ..." (P3; P4)

"... Wirit's friends have come, sir, two or three people like that sir, encouraging ..." (P2)

"... Because it's easy to feel sad so these younger siblings are the ones who bring your food. Every day sir, they look at you, help you eat ..." (P4)

4. Discussion

Tuberculosis (TB) is a disease caused by *Mycobacterium tuberculosis*. TB is an infectious disease with symptoms of

persistent cough for more than 2 weeks, prolonged fever, shortness of breath, chest pain, decreased appetite, weight loss, and night sweats. It takes a long time, approximately 6–9 months to ensure the recovery of TB patients. The misunderstanding of the procedure and the long treatment as well as the presence of infection causes TB patients to sometimes not want to take their OAT anymore. Patients usually decide on their own to stop taking their medication. The result of not being disciplined in taking medicine results in various side effects, complications, and drug resistance. Based on[24] research, knowledge is the most dominant variable in influencing the regularity of taking medication [1]. Ref. [25] states that there is a significant relationship between the perception and level of knowledge of TB patients with treatment compliance, where patients with good perceptions and knowledge levels have treatment compliance. When family members are exposed to mycobacterium tuberculosis germs and cause TB disease, it will have implications for the health of family members. Families are required to motivate and support patients to comply with their treatment. Based on[26] research, it states that out of 894 household contacts of 160 patients, 464 people (65%) were infected by TB germs. Family support will motivate the patient until finally, the patient can take their medicine regularly until they recover. [2] Providing information about health as well as health promotion and support from family and the environment can lead to social support for people with tuberculosis.[27–29]

TB patients who receive regular treatment can reduce the transmission of pulmonary TB. The treatment of pulmonary TB takes a long time; as a result, patients are prone to drop out, while irregular treatment threatens drug retention and causes problems. To prevent transmission to family members, what can be done is to motivate people with tuberculosis to remain compliant in taking the medication regularly. Coping mechanisms are all efforts made by individuals to cope with stressful and emotionally arousing demands. The coping mechanism used by the family, in this case, is in the form of family perceptions of tuberculosis disease and efforts made by the family as an effort to prevent transmission of mycobacterium tuberculosis germs to other family members. The family coping mechanism is a way of self-adjustment used by the family to deal with changes accepted by the family. Families are required not to negatively stigmatize people with tuberculosis such as differentiating food menus, avoiding people with tuberculosis or even not being involved in family activities anymore. The family's perception of tuberculosis disease will make the family try to prevent other family members from contracting tuberculosis disease. According to Ref. [30] in Uganda, 38.6% of families supported their family members in TB treatment and recovery.

Family support is needed by tuberculosis patients in undergoing treatment. Patients with tuberculosis will not be able to undergo treatment on their own. Family support is needed in order to achieve recovery in patients with tuberculosis, such as accompanying them to the health center for treatment, reminding them to take medicine, preparing nutrition, and also fetching medicine to drink and still providing motivation that the disease can be cured and the family will always help as long as patients with tuberculosis undergo treatment. There are many forms of support that can be provided by families, including emotional support, instrumental support, information support and appreciation support. Research by Ref. [31] in India found that if the family is included in the Family Directly Observed Treatment (DOT) program, the success rate of curing TB patients is 95.8% of 344 TB patients. Refs. [32–36] reported by health professionals that patients who have family support and come to the clinic accompanied by a family member or someone from the community where they live, are usually those who successfully complete their treatment.

Adherence is an individual's behavior (e.g., taking medication, adhering to a diet, or making lifestyle changes) according to therapeutic and health recommendations. The level of adherence can range from heeding every aspect of the advice to adhering to the plan. Medication adherence is a behavior that indicates the extent to which individuals follow recommendations related to health or illness. Families can be a very influential factor in determining an individual's health beliefs and values and can also determine what treatment programs they are willing to accept. Families also provide support and make decisions regarding the care of sick family members. According to Ref. [11] whether a cure is achieved is caused by irregularity or non-adherence to treatment so efforts to improve treatment adherence are a priority issue in pulmonary TB control programs. Things that increase the tuberculosis patients' adherence in their treatment include providing additional food when patients ntrol to the health center. This stimulus will motivate patients to be compliant and obedient in their treatment.

5. Conclusion

Religious organizations such as Wiritan or partangiangan need to be involved to motivate tuberculosis patients to comply with their treatment. The involvement of religious organizations can increase the adherence of TB patients. TB patients and their families need to be counseled during visits or when health workers conduct contact investigations in the field to increase their understanding of TB disease. For tuberculosis patients to adhere to their treatment, it is necessary to have the cooperation of various parties including family, community, and private practices as well as religious organizations.

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Original article

Assessment of anxiety and depression among tuberculosis patients of Ahmedabad, India

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ABSTRACT

Background: India has high prevalence of Tuberculosis (TB). The long duration of treatment and chronic nature of illness predispose a person to anxiety as well as depression. Various addiction habits may affect treatment outcome and impact mental wellbeing in TB patients. This study was planned with the objectives of finding prevalence of anxiety and depression in tuberculosis patients at Ahmedabad district and to find association between anxiety, depression and different variables of TB patients as well as to assess the addiction profile of TB patients.

Methods: A total of 600 TB patients above 18 years and having completed 3 months of anti TB treatment without any psychiatric illness were selected randomly from 3 types of health institutes where patients receive treatment namely Ahmedabad district TB center (Institute 1), one medical college attached hospital (Institute 2) and one private hospital (Institute 3).Hospital Anxiety and Depression Scale (HADS) was used to assess anxiety and depression.

Results: The mean age of study patients was 41.57 ± 13.44 years and 66.3% (398) patients were males. The prevalence of anxiety and depression was found to be 37.5% and 41.2% respectively while in 18.66% patients both anxiety and depression coexisted simultaneously. Institute 1 reported highest prevalence of anxiety (45.4%) while institute 2 reported highest prevalence of depression (42.9%). The prevalence of anxiety among drug sensitive TB patients was 32.7% while among drug resistant TB patients was 80%.The prevalence of depression in drug sensitive TB patients was 37.03% while among drug resistant TB patients was 78.3%. Anxiety had a statistically significant association with gender, occupation, socioeconomic class, type of TB, site of TB and perceived social isolation ($p < 0.05$).Except gender, depression was significantly associated with all the variables ($p < 0.05$).Tobacco addiction was found in 37.5% patients, alcohol addiction in 8.3% while 4.5% patients had both types of addiction. There was a statistically significant association found between addiction and variables like gender, residence, occupation, type of TB and site of TB.

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Conclusion: One third of patients had anxiety and more than one third had depression in which the prevalence of depression was higher than anxiety. District TB Center had highest prevalence of anxiety while medical college attached hospital had highest prevalence of depression. Anxiety and depression were higher in drug resistant TB patients. Tobacco addiction was more common than alcohol. Addiction had a significant association with depression, nonworking rural males and patients who had drug resistant pulmonary TB.

1. Introduction

Globally, Tuberculosis is considered to be one of the deadliest transmissible diseases. Despite the availability of an effective therapy and the various WHO programs, almost one third of the world population is latently infected and remains a leading infectious cause of mortality. The prevalence of tuberculosis (TB) in Indian subcontinent is very high.[1]

The self-reported point prevalence of tuberculosis was 304 per 100,000 population as per a national survey.[2] while NFHS-5 (2019–20) data for Gujarat state showed the prevalence of tuberculosis for males is 214 and for females is 216 per 100,000 population.[3]

Any long-standing physical illness negatively effects the mental wellbeing of the patient and tuberculosis with long duration of treatment is one of them.[1] Moreover, psychiatric disorders are common in many tubercular patients, and require intervention not only to improve adherence to and outcomes of medical therapy, but also to relieve suffering due to the psychiatric illnesses themselves.[4]

Anxiety is a vague, subjective, non-specific feeling of uneasiness, apprehension, tension (excessive nervousness) fears, and a sense of impending doom, irrational avoidance of objects or situation and anxiety attack.[5] Depression is a common mental disorder, characterized by sadness, loss of interest or pleasure, feelings of guilt or low self-worth, disturbed sleep or appetite, feelings of tiredness, and poor concentration.[6]

A person suffering from TB can develop depression in due course of time owing to a number of factors, namely the long duration of treatment for TB, stigma faced by the patient due to the disease, and lack of family support to name a few.[6] The studies indicate that there is high prevalence of depression and anxiety among TB patients compared to general population. Moreover, depression often comes with symptoms of anxiety.[5]

Due to paucity of literature regarding anxiety and depression in tuberculosis patients in the study area, this study was planned. The objectives of the study were to determine the prevalence of anxiety and depression in tuberculosis patients of Ahmedabad district, to compare the prevalence of anxiety and depression between the patients of different types of health institutions selected in the study, to find the association between various determinants of Anxiety and Depression and to assess addiction among tuberculosis patients and determine association between addiction and different variables.

2. Materials and methods

Present study had a cross sectional study design with study area as Ahmedabad District. Tuberculosis patients of Ahmedabad district take anti TB treatment from 3 types of health institutes: Government hospital, a stand alone private hospital and a medical college attached hospital which may be government or private. Ahmedabad District TB Center (Institute 1) was selected as being the district's major center of diagnosis and treatment. One medical college attached hospital (Institute 2) was selected randomly from the list of 6 medical colleges in Ahmedabad. A stand alone private hospital (Institute 3) was selected randomly after obtaining the list of all private hospitals offering treatment to TB patients. The sample size was determined by formula[7]:

$$N = (1.96)^2 * P * Q \div L^2$$

As per WHO data, prevalence of depression was 40% amongst TB patients.[8] Hence taking p value as 40, q (100-p) as 60. Allowable error L was taken as 10% of p which was 4. As per this formula sample size turned out to be 576.24 which was rounded off to 600.

Patients 18 years and older, giving consent and having completed at least 3 months of anti-TB treatment were included in the study. Those patients who had any other medical or psychiatric disorder were excluded from the study. Box 1 shows the distribution in patient selection across 3 types of health institutes. The number of patients from each institute was determined based on PPS(Probability proportional to size).

In current study HADS[9] Scale was used for assessing Anxiety and Depression in Tuberculosis patients. Study was started after receiving permission from Institutional Ethics Committee and data collection was completed within 18 months. The entire study was started in late 2019 and completed in 2021. Data entry was done in MS excel and data analysis was carried out using SPSS (Statistical package for social sciences) version 26.

3. Results

The mean age of study participants was 41.57 ± 13.44 years. As shown in Table 1, Male patients (66.3%), Hindu religion (90.7%), Married status (72.7%), urban area of residence (72.3%) were more commonly reported. Working participants were

Box 1
Distribution of patients(n = 600) across different health institutes

Institute	Drug Resistant (10%)	Drug Sensitive (90%)	Total
Institute 1-District TB Centre	28	260	288
Institute 2-Medical College attached hospital	23	205	228
Institute 3-Private hospital	9	75	84
Total	60	540	600

more (59.5%) and those who had undergone any form of schooling (primary, secondary and higher secondary) were maximum (56.8%). Upper middle class was the most common socioeconomic class (42.1%) as per modified BG Prasad Classification[10] (*AICPI September 2019[11] = 322).

The prevalence of Anxiety among Tuberculosis patients reported maximum by 225 (37.5%) patients, borderline by 206 (34.3%) patients and 169 (28.2%) patients had no Anxiety. Depression was reported maximum by 247 (41.2%) patients while 161 (26.8%) patients had Borderline Depression.192 (32%) had no depression. There were total 112 (18.66%) TB patients who had both anxiety and depression. The prevalence of anxiety among drug sensitive TB patients was 32.7% while among drug resistant TB patients was 80%.The prevalence of depression in drug sensitive TB patients was 37.03% while among drug resistant TB patients was 78.3%.

Institute 1 (District TB Center) had the highest prevalence of anxiety (45.4%) as shown in Fig. 1. Institute 2 (Medical college attached hospital) had highest prevalence of depression (42.9%). Those patients who had both anxiety and depression were found maximum in Institute 1 (27%).

As shown in Table 2, Anxiety had a statistically significant association with gender, occupation, socioeconomic class, type of TB, site of TB and perceived social isolation.

Table 1 – Sociodemographic profile of tuberculosis patients (n = 600).

Variable	Categories	Frequency (%)
Gender	Female	202 (33.7)
	Male	398 (66.3)
Religion	Hindu	544 (90.7)
	Muslim	51 (8.5)
	Others	5 (0.8)
Marital Status	Married	436 (72.7)
	Unmarried	164 (27.3)
Residence	Urban	434 (72.3)
	Rural	166 (27.7)
Occupation	Working	357 (59.5)
	Nonworking	243 (40.5)
Education	Illiterate	103 (17.2)
	Schooling	341 (56.8)
	Graduate and above	156 (26)
Socioeconomic Class* (Modified B.G.Prasad Classification)	Upper	156 (26)
	Upper Middle	253 (42.1)
	Middle	101 (16.9)
	Lower Middle	85 (14.1)
	Lower	5 (0.9)

Depression had a statistically significant association with all variables except gender as shown in Table 3.

Addiction details of the study subjects is shown in Fig. 2 above. Out of total 600 patients only tobacco addiction (includes smoking and smokeless) was seen most commonly in 225 (37.5%) patients followed by only alcohol 50 (8.3%) and 27 (4.5%) patients had both types of addiction.

There was a statistically significant association found between Addiction and Variables like gender, residence, occupation, type of TB and site of TB as shown in Table 4.

4. Discussion

The mean age of study participants was 41.57 ± 13.44 years. A recent study done in 2020 at Multan in Pakistan[12] had a mean age of 43.12 ± 12 years which is similar to the present study findings. Males were more common (66.3%) in the present study similar to a study at Indore[4] (64%). Rural area of residence was found in 27.7% TB patients while majority of them (72.3%) lived in urban Ahmedabad. Migration of populations, rise in Urban slums, overcrowding, lack of proper ventilation, lack of personal hygiene, malnutrition may be the possible causative agents responsible for this rural urban difference.

A study at Punjab[13] showed that most of the TB patients (62.6%) belonged to lower socioeconomic class while present study showed that 73% TB patients belonged to Middle Class. This could be due to difference in income, expenditure and nutritional status of the two regions.

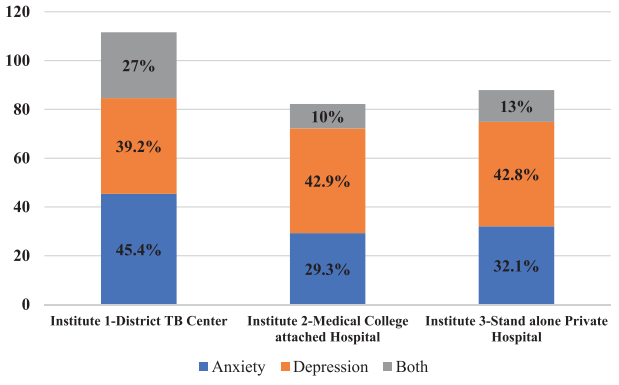

Fig. 1 – Institute wise Prevalence (%) of Anxiety and Depression among TB patients.

Table 2 – Association between different variables and Anxiety in Study Patients (n = 600).

Variables		Anxiety				
		Yes	Borderline	No	Total	χ^2 test statistic (p value)
Gender	Male	145	128	125	398	6.39**(0.041)**
	Female	80	78	44	202	
Residence	Rural	62	64	40	166	2.54 (0.281)
	Urban	163	142	129	434	
Education	Illiterate	39	36	28	103	3.952 (0.413)
	Schooling	137	114	90	341	
	Graduation	49	56	51	156	
Occupation	Working	116	131	110	357	9.51**(0.009)**
	Nonworking	109	75	59	243	
Marital Status	Married	165	153	118	436	1.006 (0.605)
	Unmarried	60	53	51	164	
Socio-Economic Class	Upper	58	52	46	156	47.52**(<0.0001)**
	Upper Middle	78	95	80	253	
	Middle	29	36	36	101	
	Lower Middle	55	23	7	85	
	Lower	5	0	0	5	
Addiction	Yes	114	97	91	302	1.71 (0.425)
	No	111	109	78	298	
Type of TB	Drug Sensitive	177	199	164	540	51.39**(<0.0001)**
	Drug Resistant	48	7	5	60	
Site of TB	Pulmonary	197	143	108	448	33.10**(<0.0001)**
	Extrapulmonary	28	63	61	152	
Perceived Social Isolation	Yes	193	132	101	426	39.02**(<0.0001)**
	No	32	74	68	174	

Bold values indicate a statistically signifiant association between variables of the study.

Table 3 – Association between different variables and Depression in Study Patients (n = 600).

Variables		Depression				
		Yes	Borderline	No	Total	χ^2 test statistic (p value)
Gender	Male	172	100	126	398	2.53 (0.282)
	Female	75	61	66	202	
Residence	Rural	84	45	37	166	11.73**(0.003)**
	Urban	163	116	155	434	
Education	Illiterate	63	21	19	103	33.96 **(<0.0001)**
	Schooling	143	94	104	341	
	Graduation	41	46	69	156	
Occupation	Working	111	112	134	357	36.93**(<0.0001)**
	Nonworking	136	49	58	243	
Marital Status	Married	197	104	135	436	12.067 **(0.002)**
	Unmarried	50	57	57	164	
Socio-Economic Class	Upper	55	34	67	156	22.20**(<0.0001)**
	Upper Middle	105	67	81	253	
	Middle	39	33	29	101	
	Lower Middle	44	26	15	85	
	Lower	4	1	0	5	
Addiction	Yes	155	69	78	302	26.07**(0.0001)**
	No	92	92	114	298	
Type of TB	Drug Sensitive	200	153	187	540	38.56**(<0.0001)**
	Drug Resistant	47	8	5	60	
Site of TB	Pulmonary	239	102	107	448	111.04 **(<0.0001)**
	Extrapulmonary	8	59	85	152	
Perceived Social Isolation	Yes	222	110	94	426	88.61**(<0.0001)**
	No	25	51	98	174	

Bold values indicate a statistically signifiant association between variables of the study.

Tobacco addiction analysis in the present study showed that 164 (27.3%) of TB patients were having smokeless tobacco addiction which is less in comparison to results of Tobacco chewing addiction studies done in selected Gujarat districts, Mehsana[14] (34.52%) and Jamnagar[15] (32.9%).This variation may be due to difference in the time duration of studies

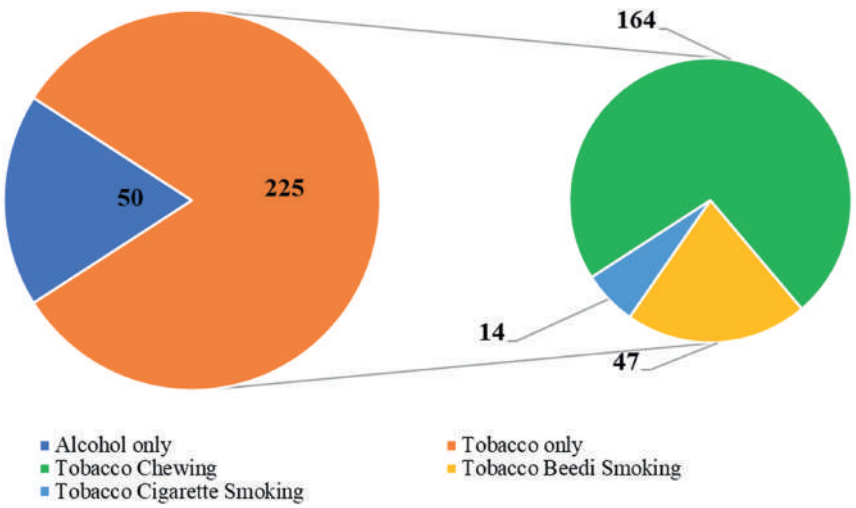

Fig. 2 – Details about addiction in study subjects.

Table 4 – Association between different variables and Addiction in Study Patients (n = 600).

Variables		Addiction			
		Yes	No	Total	χ^2 test statistic (p value)
Gender	Male	278	120	398	180.1(**<0.0001**)
	Female	24	178	202	
Residence	Rural	102	64	166	11.36(**0.001**)
	Urban	200	234	434	
Occupation	Working	129	228	357	71.08(**<0.0001**)
	Nonworking	173	70	243	
Type of TB	Drug Sensitive	264	276	540	4.50(**0.034**)
	Drug Resistant	38	22	60	
Site of TB	Pulmonary	250	198	448	21.16(**<0.0001**)
	Extrapulmonary	52	100	152	

Bold values indicate a statistically signifiant association between variables of the study.

conducted and people's tobacco habits between the regions in the state. Alcohol use was noted in 12.83% TB patients in the present study which is nearer to a study done at Bhavnagar City[16] of Gujarat (20%).

The anxiety prevalence in the present study (37.5%) which used HADS Scale was found similar to the other studies which used the same data collection tool done at Indore[4](34%) and Brazil[17](38.4%). Ethiopia[9] showed 41.5% anxiety and Romania [24] showed 43% anxiety prevalence which is nearer to the results of present study.

Depression was present in 41.2% of the study participants in the current study while 26.8% had borderline depression. Prevalence of depression was similar to studies done at Ethiopia[5] (43.4%) and Romania[18](46%).Depression and type of Residence had a significant statistical association (χ^2:11.73,$p < 0.05$).Similar association was found between area of Residence and Depression ($p < 0.05$) in a study at Multan,[12]Pakistan. Presence of Addiction in TB patients had a statistically significant association (χ^2:26.07, $p < 0.0001$) with Depression. A study at China[19] revealed that depression in TB patients who were current and former smokers were higher as compared to non-smokers which is similar to the results of this study.

There was a statistically significant association between Occupation and Anxiety (χ^2:9.515, p=<0.05) as well as between Occupation and Depression (χ^2:36.939, p=<0.0001). Not Working or not going to work can negatively impact a person's mental health which can lead to Anxiety and Depression. Present study also showed more addiction in Pulmonary TB patients (χ^2:21.16, p=<0.0001), and Drug Resistant TB patients (χ^2:4.5, p=<0.05). Addiction is one of the reasons for treatment failure in TB patients. Being socially isolated was perceived by 71% of TB patients in this study. This makes a diseased individual feel loneliness and low self-esteem and may lead to Anxiety and Depression. This is shown by a statistically significant association of perceived social isolation with Anxiety (χ^2:39.02, p=<0.0001) and Depression (χ^2:88.61, p=<0.0001) in the present study.

5. Conclusion

More than half of the TB patients were males, married, working and residing in urban area. One third of patients had anxiety and more than one third had depression in which the prevalence of depression was higher than anxiety. Patients attending District TB Center had the highest prevalence of anxiety while those receiving treatment from medical college attached hospital showed highest prevalence of depression. Anxiety and Depression were more prevalent in drug resistant

TB patients. Type TB, site of TB and perceived social isolation were significantly associated with both Anxiety and depression. Tobacco addiction was the more common than alcohol. Addiction had a significant association with depression and was more commonly associated with nonworking rural males and patients with drug resistant pulmonary TB.

Conflicts of interest

The authors have none to declare.

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High stigma prevalence and associated factors among TB patients in Southern Afghanistan: A multi-center cross-sectional study

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ABSTRACT

Background: TB stigma represents a growing threat to TB care. Understanding TB stigma distribution and associating factors is crucial for effective TB control in Afghanistan.
Objectives: To profile the prevalence of TB-related stigma and its associating factors among TB patients in Southern Afghanistan.
Methods: In this multi-center cross-sectional study, we randomly recruited 603 adult TB patients from 2 major TB treatment sites in Southern Afghanistan. A score of >8 on the Stigma Scale for Chronic Illness-8 items (SSCI-8 items) was considered as positive for TB-related stigma. We fitted a binary logistic regression model.
Results: Out of the 603 TB patients included in this study, 88.3% (95%CI: 85.8–90.9%) had TB-related stigma using the SSCI-8 cutoff (>8). Being in the age group 18–40 years, rural residence, no formal education, severe perception of illness, lack of TB knowledge, and symptoms of depression had positive associations with TB stigma.
Conclusion: A considerable percentage (88.3%) of patients had TB stigma. We identified potential risk factors that could serve as a benchmark for guiding policy efforts and interventions that aim to reduce stigma among TB patients in Afghanistan.

1. Introduction

Tuberculosis (TB)-related stigma, encompassing discrimination, shame, and feelings of unworthiness, has been viewed as a significant barrier to TB control.[1] Numerous studies show that stigma is prevalent in people affected by TB across communities and results in a wide range of adverse and enduring outcomes.[2–4] TB stigma has been associated with substantial medical, and social consequences and may jeopardize TB care.[4,5]

Prior research has noted higher rates of stigma among TB patients, especially within high-burden countries.[6–8] Approximately 42%–82% of TB patients have been reported to suffer from TB-related stigma across different countries and studies.[4,7] The World Health Organization (WHO) classified "stigma around TB" as a significant challenge against TB control in Afghanistan.[9] However, no previous research has investigated stigma among Afghan TB patients.

Several studies have identified factors linked to TB stigma.[2,3,7] These include age, sex, education level, residence, marital status, income, family history of TB, TB knowledge, disease severity, medical comorbidity, depression symptoms, and social support level.[2,4,6,10] However, prior studies have highlighted context and intercultural differences in factors associated with TB-related stigma.[11] Hence, understanding context and culture-specific factors that underpin the feelings of stigma in TB patients has important implications.

Meanwhile, TB-related stigma can be reliably reduced.[11,12] Numerous studies have tested interventions aimed at reducing TB stigma in many settings.[1,13,14] The authors of a scoping review concluded that psychosocial assistance and educational interventions appear to be effective in most settings.[13] Counseling, text messaging, and community campaigns also have been deployed in some low and middle-income countries (LMICs).[11,13,14] Moreover, TB-related stigma reduction efforts are essential components of national TB elimination programs (NTEPs) in some settings.[11]

However, to our knowledge, stigma among Afghan TB patients has

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not yet been reported, and research into this topic is an urgent public health need. We, therefore, decided to assess the stigma experienced among TB patients in Southern Afghanistan. Moreover, we aimed to examine the association between TB-related stigma and a wide range of factors, such as sociodemographic characteristics, TB knowledge and counseling, clinical attributes, mental health conditions, and social support levels.

2. Methods

A cross-sectional questionnaire-based study was employed to collect data from TB patients attending 2 major TB treatment sites (TB Provincial Center in Helmand and Mirwais Regional Hospital in Kandahar) in Southern Afghanistan from 5th, January 2024 to 31st, March 2024. The selected study sites are major TB treatment facilities in the south, which are responsible for providing comprehensive TB care services for patients in the whole region. Moreover, the study sites were selected to ensure a mixture of geography, culture, and socioeconomic reflective of the entire Southern Afghanistan.

Study participants were recruited from a sample of 1082 TB patients receiving anti-TB treatment from the designated study sites. The eligibility criteria for enrolling potential participants into the study were active TB diagnosis, 18 years or older, and coming for anti-TB treatment follow-up to the study sites. We excluded drug-resistant (2) and non-consenting (13) patients.

The sample size was determined using the sample size calculation formula [$n = Z^2P\ (1-P)/(d)^2$], where p was assumed as 0.5 (maximum estimates), Z as 1.96, and d = 0.05. While considering a 1.5 design effect and a 10% non-response rate, a total of 625 TB patients were sufficient to profile the prevalence of stigma.

We proportionately allocated our calculated sample size. Accordingly, 370 and 233 patients were allocated to Mirwais Regional Hospital and Helmand Provincial TB Center, respectively. The list of TB patients (TB registers in both study sites) was used as a sampling frame, and then individual patients were recruited by random sampling (lottery method) procedure.

TB stigma was measured with the Stigma Scale for Chronic Illness (SSCI-8) consisting of 8 items, and scored on a 5-point Likert scale.[7] A score of >8 on the SSCI-8 questionnaire was considered as positive for the outcome variable (TB stigma). The SSCI-8 is a valid psychometric questionnaire in TB patients.[7] Cronbach's alpha was 0.93.

The independent variables we examined were sociodemographic characteristics, clinical attributes, depression symptoms, and social support levels.

We used PHQ-9 (Patient Health Questionnaire) to screen for the symptoms of depression.[15] The sum of scores in PHQ-9 ranges from 0 to 27 and respondents were categorized according to the severity of depression symptoms.[15] A score of ≥10 (the cut-off) was classified as a possible depressive disorder.[15] We used the Pashtu version of PHQ-9, which was previously utilized by relevant studies in Afghanistan.[16,17] Cronbach's α was 0.90.

We used the 3-item Oslo Social Support Scale (OSSS-3) questionnaire to measure social support levels.[18] The sum of scores ranges from 3 to 14, and social support was classified into three categories: low (3–8 scores), intermediate (9–11 scores), and high (12–14 scores).[18] Cronbach's α was 0.87.

A structured questionnaire was prepared in Pashtu (local language) to record information for this study and included five sections: sociodemographic data, clinical attributes, SSCI-8, PHQ-9, and OSSS-3. The questionnaire was pilot-tested among 50 TB patients (28 males and 22 females) from two TB treatment facilities not included in the main study.

All information was elicited through face-to-face interviews by eight interviewers (4 males/females) specially trained for this study. The principal investigators and ethics committee monitored the study procedures.

Data analyses were completed using SPSS version 24.0 in April 2024. Initially, we calculated descriptive statistics. In order to compare differences in the sociodemographic characteristics, clinical data, depression symptoms, and social support levels relating to TB stigma, we employed a chi-square test. Moreover, binary logistic regression was applied to determine factors most associated with stigma experience at 5% significance level.

The study received approval from the Ethics Committee, and administrative approval was granted by site-specific administrations. All patients provided written or oral informed consent. The study adhered to the Declaration of Helsinki and other established ethical guidelines.

3. Results

Of the 603 TB patients included in the study; 304 (50.4%) were females, 309 (51.2%) were rural residents, 462 (76.6%) were married, and 213 (35.3%) were aged between 26 and 40 years. Further, 304 (56.4%) had no formal education, 248 (41.1%) were homemakers, 525 (87.1%) were living in households with greater than 5 persons, and 382 (63.3%) had 5000-10,000 Afghanis monthly income (Table 1).

Of the total participants, 578 (95.9%) were new cases, 529 (87.7%) presented with pulmonary TB (PTB), and more than one-sixth (16.6%) had a family history of TB. Moreover, 248 (41.2%) perceived their illness severe, 130 (21.6%) were on treatment since 1–2 months, 230 (38.1%) had medical comorbidity, and a significant proportion (40.8%; 246) had no knowledge of TB. A minority (10.3%) of them had high social support. Overall, 465 (77.2%) patients had depressive symptoms, while nearly half (47.8%) had a probable depressive disorder (≥10 score on PHQ-9) (Table 2).

Out of the 603 TB patients included in this study, 88.3% (95%CI: 85.8–90.9%) had TB-related stigma using the SSCI-8.

Based on binary logistic regression analysis results, being in the age group 18–40 years [AOR = 5.16, 95%CI (2.53–10.5)], rural residence

Table 1
Sociodemographic characteristics of respondents (n = 603).

Variables	Frequency (%)
Age (in years)	
18–25	157 (26.0)
26–40	213 (35.3)
41–60	159 (26.4)
>60	74 (12.3)
Sex	
Male	299 (49.6)
Female	304 (50.4)
Residence	
Urban	294 (48.8)
Rural	309 (51.2)
Marital status	
Single	105 (17.4)
Married	462 (76.6)
Widowed/Divorced	36 (6.0)
Education	
No formal education	340 (56.4)
Religious	112 (18.6)
Primary	83 (13.8)
Secondary	24 (4.0)
Higher studies	44 (7.2)
Employment	
Employed	103 (17.1)
Student	20 (3.3)
Farmer	45 (7.5)
Housewife	248 (41.1)
Unemployed	187 (31.0)
Household members	
2–5	78 (12.9)
>5	525 (87.1)
Household income (monthly)	
5000-10,000	382 (63.3)
>10,000	221 (36.7)

Table 2
Clinical profile of respondents (n = 603).

Variables	Frequency (%)
TB patient	
New	578 (95.9)
Relapse	22 (3.6)
Lost to follow-up	3 (0.5)
TB type	
Pulmonary	529 (87.7)
Extrapulmonary	74 (12.3)
Disease perception	
Very severe	29 (4.8)
Severe	248 (41.2)
Moderately severe	135 (22.4)
Not very severe	163 (27.0)
Not severe at all	28 (4.6)
Treatment duration (in months)	
1–2	130 (21.6)
3–4	123 (20.4)
5–6	350 (58.0)
Family history of TB	
Yes	100 (16.6)
No	503 (83.4)
TB knowledge	
Yes	357 (59.2)
No	246 (40.8)
Counseling	
Yes	479 (79.4)
No	124 (20.6)
Depression symptoms	
No	138 (22.8)
Mild	177 (29.4)
Moderate	196 (32.5)
Severe	80 (13.3)
Extremely severe	12 (2.0)
Social support levels	
Low	371 (61.5)
Intermediate	170 (28.2)
High	62 (10.3)
Medical comorbidity	
Yes	230 (38.1)
No	373 (61.9)
Currently smoking	
Yes	53 (8.8)
No	550 (91.2)

[3.88 (1.89–7.99)], no formal education [5.01 (2.29–10.9)], severe perception of illness [2.42 (1.22–4.78)], lack of TB knowledge [11.4 (3.74–35.1)], and depression symptoms [5.28 (1.48–18.7)] had positive associations with TB stigma (Table 3).

4. Discussion

This multi-center cross-sectional study of 603 TB patients in Southern Afghanistan demonstrated that 88.3% of patients met the criteria for TB stigma. We observed high levels of stigma experience among patients aged 18–40 years, residing in rural areas, being illiterate, having a severe perception of illness, lacking TB knowledge, and those with depression symptoms.

The prevalence of stigma in this sample was 88.3% (95%CI: 85.8%–90.9%). Previous studies reported TB stigma between 42% and 82% in other countries.[2–4,6,7] This tells us that higher levels of stigma among Afghan TB patients may reflect the high levels of social and cultural misgivings and beliefs regarding TB disease in Afghanistan. Furthermore, previous studies have documented poor TB knowledge across Afghan communities, which may also explain the higher prevalence of TB stigma reported by the current study.[19–21] Given that TB-related stigma potentiates the risk for worse health outcomes, targeted interventional measures and actions are required to mitigate the burden of stigma among Afghan TB patients.

The prevalence of stigma was observed to vary by the age group, with the highest prevalence found among patients aged 18–40 years. Differences in stigma prevalence by the age of TB patients have been shown in previous studies-for example, a multi-site cross-sectional analysis of stigma prevalence among 612 TB patients in Indonesia reported higher rates of stigma in younger patients.[22] Conversely, higher prevalence of stigma was associated with advancing age, a finding reported by a study from Karnataka, India.[10] The differences in the association between age groups and TB stigma documented in previous studies may be due to other context-specific and sociocultural factors. TB patients may experience differing levels of stigma based on health literacy, community roles, and access to healthcare.[10,22] Additionally, cultural beliefs, media access, and the effectiveness of public health campaigns contribute to how TB is perceived and stigmatized across different age groups.[3,7,22,23] In terms of policy relevance, stigma reduction efforts for TB patients in Afghanistan should prioritize young patients.

Similar to other studies,[23,24] we found a higher prevalence of stigma among rural residents. The higher rates of stigma in rural residents may be explained by the fact that residents in rural Afghanistan are highly depressed, lack formal schooling, encounter barriers to accessing health educational activities, and perform worse in health-seeking behaviors.[25–27] Considering this rural disadvantage, tailored interventions to reduce TB-related stigma should be prioritized among TB patients residing in rural areas. Moreover, this finding also calls for further studies to delve into contextual and sociocultural factors contributing to the heightened prevalence of TB stigma among rural residents in Afghanistan.

We found that patients with no formal education had higher odds of experiencing TB stigma than literate patients. A consistent pattern between low educational levels and TB stigma has been reported in the literature.[8,28–30] According to the existing literature from Afghanistan and elsewhere,[25,28,29] low health literacy, susceptibilities to societal prejudices and stigmatizing beliefs, and lack of appropriate knowledge about TB could be the reasons behind the association between low educational attainment and the risk of TB-related stigma. This suggests that illiterate patients should be prioritized for interventions to reduce the trajectories of stigma among TB patients.

A higher experience of stigma was observed among patients who had a severe perception of their illness, aligning with prior studies.[2,6,8] As noted previously, prior research suggests that a severe perception of illness results in substantial sequelae.[23,31] Therefore, TB patients should be counseled appropriately on disease treatment, progression, and prognosis.

The present study also found that patients with a lack of TB knowledge reported a greater prevalence of TB-related stigma. Previous studies have provided evidence for a causal association between poor TB knowledge and the experience of TB stigma.[3,28,30] Literature originating from Afghanistan reports a markedly low TB knowledge among patients and the general population.[19,20,32,33] TB knowledge plays a vital role in overall TB control, and there is a need for policy efforts and interventions to ensure appropriate TB knowledge in patients and the general population.

Another prominent finding was the significant association between depression symptoms and TB stigma, which is consistent with prior studies.[22,34] However, no significant association was observed in a study from India.[7] Stigma experience can also contribute to mental health symptoms.[22] In the present study, approximately half (47.8%) of participants had a probable depressive disorder. The consistent exposure to combat, ongoing sociopolitical instability, high levels of unemployment, and financial hardships may account for the higher rates of depression symptoms observed in our sample.[35–37] Therefore, TB patients with mental health symptoms warrant adequate psychosocial care in addition to TB treatment to improve overall well-being.[38,39]

Table 3
Logistic regression analysis results of factors associated with TB stigma; crude and adjusted odds ratios with 95% CIs.

Covariates	Categories	TB-related stigma		COR (95% CI)	P-Value	AOR (95% CI)	P-Value
		Yes	No				
Age	18–40	342	28	2.68 (1.61–4.72)	<0.001	5.16 (2.53–10.5)	<0.001
	>40	191	42	1		1	
Sex	Male	255	44	1	0.018	–	–
	Female	278	26	1.84 (1.10–3.08)			
Residence	Rural	295	14	4.95 (2.69–9.12)	<0.001	3.88 (1.89–7.99)	<0.001
	Urban	238	56	1		1	
Educational status	Educated	211	52	1	<0.001	1	<0.001
	Uneducated	322	18	4.40 (2.51–7.74)		5.01 (2.29–10.9)	
Employment status	Employed	136	32	1	<0.001	–	–
	Unemployed	397	38	2.45 (1.47–4.08)			
Household income	5000-10,000	344	38	1.53 (0.92–2.53)	0.094	–	–
	>10,000	189	32	1			
TB type	Pulmonary	473	56	1.97 (1.03–3.75)	0.036	–	–
	Extrapulmonary	60	14	1			
Disease perception	Severe	380	32	2.94 (1.77–4.89)	<0.001	2.42 (1.22–4.78)	0.011
	Not severe	153	38	1		1	
Treatment duration	1–2 months	124	6	3.23 (1.36–7.64)	0.005	–	–
	>2 months	409	64	1			
TB knowledge	Satisfactory	295	62	1	<0.001	1	<0.001
	Unsatisfactory	238	8	6.25 (2.93–13.3)		11.4 (3.74–35.1)	
Medical comorbidity	Yes	210	20	1.62 (0.94–2.80)	0.080	–	–
	No	323	50	1			
Counseling	Yes	419	60	1	0.167	–	–
	No	114	10	1.55 (0.81–2.94)			
Probable depressive disorder	Yes	282	18	3.24 (1.85–5.69)	<0.001	5.28 (1.48–18.7)	0.010
	No	251	52	1		1	
Social support	Low High	355	24	3.82 (2.26–6.46)	<0.001	–	–
		178	46	1			

5. Limitations

We have provided insights, for the first time to our knowledge, about TB stigma and its associating factors by using a credible rating scale among TB patients in Afghanistan. Our findings may provide a foundational evidence base for policymakers and healthcare professionals to design effective public health interventions.

This study has its limitations. First, we cannot determine the causal relationship between associated factors and outcome variable because of the study design. Second, all data were self-reported and are subject to information bias. Third, patient-doctor communication influence was not examined for stigma experience. Finally, our study was restricted to TB patients in Southern Afghanistan, and thus, our prevalence of TB stigma may not hold for the country in general.

6. Conclusion

A considerable percentage (88.3%) of patients suffered from TB-related stigma. We identified potential risk factors that could serve as a benchmark for guiding policy efforts and interventions that aim to reduce stigma among TB patients in Afghanistan.

Conflicts of interest

The authors have none to declare.

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None.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Change in psychological parameters and quality of life among individuals with pulmonary and extrapulmonary tuberculosis following the intensive phase of therapy: A longitudinal observational study from central India

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ABSTRACT

Background: Tuberculosis (TB) is a global health concern, impacting millions annually, with limited attention to the psychological distress it inflicts. Psychological comorbidities, such as depression, anxiety, and stress, significantly affect the quality of life (QoL) of TB patients. Available literature on this topic is restricted to the pulmonary TB (PTB) patients; while psychological issues of the extrapulmonary TB (EPTB) patients who comprise a significant proportion of this disease entity remains unexplored. Additionally, the impact of anti-TB treatment on psychological parameters has received limited attention and vice-versa. This study aimed to assess depression, anxiety, stress, and QoL of TB patients at diagnosis and to understand how these parameters change after the intensive phase of treatment.

Methods: A longitudinal observational study involving 40 TB patients (31 EPTB and 9 TB) was conducted to assess depression, anxiety, stress and QoL among them. Participants were followed up after the intensive treatment phase.

Results: At baseline, 32.5% (n = 13) and 65% (n = 26) participants experienced moderate-severe depression, and moderate-severe anxiety, and stress, respectively. QoL was notably compromised, especially in the psychological domain. Post-intensive treatment, anxiety and depression showed significant improvement ($Z = -2.271$, $p = 0.023$ and $Z = -2.093$, $p = 0.036$), but QoL and stress levels remained largely unchanged ($p > 0.05$).

Conclusion: This study highlights the high prevalence of psychological distress and poor QoL among TB patients. Following intensive phase of therapy, severity of depression and anxiety reduced significantly; however, change in stress-level and QoL was non-significant. Although study is limited by in terms for small sample size, the need of holistic, multidisciplinary treatment approach (including mental health professionals) for such patients can't be overemphasized. Implementing baseline psychological screenings and providing mental health support if required, are critical to improve the overall health and QoL of these individuals.

1. Introduction

Tuberculosis (TB) remains a significant global health burden, resulting in millions of deaths each year.[1] While much consideration has been given to the physical health aspects of TB, the psychological distress experienced by TB patients has been largely neglected, particularly in low-and middle-income countries (LMICs) such as India.[2] Available literature in this topic clearly shows that these patients suffer from significant psychiatric comorbidities.[2] Psychological problems, such as depression, anxiety and stress have been recognized as a critical factor affecting the quality of life (QoL) of individuals in various disease conditions.[3] Similarly, patient of Tuberculosis have been shown to

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experience significantly high rates of depression, anxiety and stress.[4–6]

The psychological distress among the individuals suffering from TB is influenced by various psychosocial factors, including social status, poverty, education, gender, and support from family and friends.[6–9] Additionally, the social stigma associated with TB exacerbates the psychological state of these individuals.[10,11] TB inflicts physical suffering and affects the health-related quality of life (HRQOL) of patients. Research has focused on various domains to assess HRQOL in TB patients, including physical, emotional, and social well-being. However, measuring HRQOL in TB patients remains challenging due to the disease's complexity and diverse clinical presentations.[12,13] Active TB patients typically exhibit lower HRQOL scores, with physical and psychological domains being the most affected.[14]

The treatment for drug-sensitive tuberculosis whether pulmonary or extrapulmonary, remains same and the disease usually responds to standard anti-TB drug therapy. The National Tuberculosis Elimination Program (NTEP) regimen for the treatment of the TB is given in two phases: 1. Intensive phase consists of 8 weeks (56 doses) of isoniazid (H), rifampicin (R), pyrazinamide (Z) and ethambutol (E) given under direct observation in daily dosages as per weight band categories, 2. Continuation phase (CP) consists of similar drug regimen (16 weeks (112 doses) of isoniazid, rifampicin and ethambutol in daily dosages), however, pyrazinamide is not the part of it. The CP needs to be extended up to 24 weeks in certain forms of TB like CNS TB, Skeletal TB.[15,16]

Importantly, the drugs used in the treatment of TB have been implicated in psychological- and mood related-symptoms (e.g., anxiety, irritability, depression, mania, psychosis, insomnia) in these patients.[17,18] However, very few studies have investigated progression of the psychological parameters, including change in the magnitude of these problems, with the anti-tubercular treatment. Notably, most research looking into the psychological aspects of persons with TB has been conducted on pulmonary TB patients while psychological aspects in extrapulmonary TB (EPTB), which comprise more than 20% of the TB burden in India, is a neglected area. The clinical manifestations and progression of extra-pulmonary tuberculosis are diverse (depending upon the organ system involved); moreover, paradoxical reactions (that is clinical or radiological worsening of pre-existing TB lesions or the development of new lesions in a patient who initially improves with anti-TB therapy) are more common in individuals with EPTB. Research shows that persons suffering from EPTB are prone to develop various psychological issues and experience poor QoL; common extra-pulmonary sites involved in paradoxical reactions such as lymph nodes, pleura, and CNS have additional risk of developing significant psychological stressor.[15] Therefore, it is worthwhile to investigate the psychological problems in these lot of individuals.

This highlights that despite the advances in TB treatment, psychological aspects of TB (and its treatment) on the patients and interventions for such psychological problems have received little attention. Moreover, research on psychological aspects and QOL in extra-pulmonary TB is elusive. Hence, the current study aimed at assessing the various psychological parameters such as depression, stress, anxiety and quality of life of TB patients (with at least 50% of the ETB patients) at diagnosis and to understand how these parameters change after the intensive phase of TB treatment.

2. Methodology

The longitudinal observational study was conducted at the Directly Observed Therapy Short Course (DOTS) centre, at All India Institute of Medical Sciences (AIIMS), Bhopal, a tertiary care hospital from Central India, through convenience sampling from 1st February 2023 to 20th July 2023 after approval from Institutional Ethics Committee (RC/2022/IM-TA/UG(M)/224). Employing convenience sampling with an initial target of recruiting at least 25 ETB patients, consecutive patients being initiated on treatment for TB for the first time (new patients) at the DOTS Centre were approached. Consenting patients of age ≥18 years (to have a homogeneous population, adults having distinct psychosocial issues, ensuring adequate ethical compliance, and for ease of recruitment), within one week of treatment initiation, and willing to come for follow up at the end of intensive phase of therapy (that is, after two months of treatment initiation) at the same treatment facility were included in the study. However, known cases of psychiatric disorders and those suffering from other severe medical conditions (such as chronic renal failure, uncontrolled diabetes mellitus, Human immunodeficiency virus infection and acquired immune deficiency syndrome [HIV-AIDS], etc.) as they could independently impact the psychological variables or QoL of these patients were excluded from the study. Also, individuals who were non-compliant to NTEP regime were excluded from the results and listing.

The data collection was carried out at the DOTS Centre of our institute. The data collection, including informing the potential participants about the purpose of the study, obtaining informed consent, and collecting their basic socio-demographic and clinical details, and getting their responses on the clinical outcome of the interest were initially carried out by the two undergraduate student investigators (SV or EB) under the supervision of a qualified psychiatrist (SG). This was followed by independent data collection by the students who were adequately trained by the psychiatry consultant with a provision of on-site support on as and when required basis. The semi-structured questionnaire was developed to collect information about the socio-demographic details of the participants and their clinical profiles (duration of TB, type of TB, current medications, etc.) using KoBo Toolbox. Follow-up assessment was also conducted using the same platform, by the same interviewers for the respective participants to minimize the inter-rater bias.

2.1. Outcome measures

The following scales were used to assess the various psychological parameters. All the scales used were freely available and did not warrant a permission for academic non-profit research, except Hindi PSS-10, for which permission from the developer was acquired.

1. Physical health questionnaire-9 (PHQ -9): It evaluates level of depression in the last two weeks. It categorises the patients based on the severity of the depression (Mild, moderate, severe, very severe). PHQ-9 is a multipurpose instrument for screening, diagnosing, monitoring, and measuring the severity of depression. It has sound psychometric properties and can be used across different races, gender, and cultural contexts and takes less than 3 min to complete. Higher score indicates increased severity of depression.[19]
2. Generalized Anxiety Disorder–7 (GAD -7): The GAD-7 scale is a 7-item questionnaire used to quantify the self-reported magnitude of anxiety symptoms in the participants during the previous fortnight. It categorises the patients based on the severity of anxiety into mild, moderate, and severe. It is widely used screening instrument for the anxiety disorders & has sound psychometric properties, can be used across different races, gender, and cultural contexts. It requires about 1–2 min to complete.[20]
3. Perceived Stress Scale-10: Widely used to assess stress levels in young people and adults aged 12 and above. It evaluates the degree to which an individual has perceived life as unpredictable, uncontrollable, and overloading over the previous month. It takes 5–10 min to complete and is for individual or group administration. It has sound psychometric properties and can be used across different races, gender, and cultural contexts. The Hindi version of this scale was used in the present study, which was obtained from the developer[21,22]
4. WHO Quality of life –Bref (WHO QOL (BREF)): It assesses the quality of life of an individual in last four weeks under the following domains: physical, psychological, social, and environmental. It is a freely available tool to assess QoL. It has been extensively used in research, including in India. The WHOQOL-BREF has shown good

discriminant validity, content validity, internal consistency, and test–retest reliability. The scores were transformed into 0–100 scoring as per the WHO-QoL guidelines. Higher score denotes higher quality of life.[23]

2.2. Establishment of diagnosis of extra-pulmonary TB

Six out of nine PTB patients (66.7%), were microbiologically confirmed (Sputum acid fast bacilli [AFB] smears were positive by GeneXpert/MTB culture). The rest three were diagnosed clinically.

EPTB was diagnosed and proven by way of histology (all lymph node TB cases), biopsy, GeneXpert and MTB culture positivity, pleural fluid lymphocytosis and high adenosine deaminase level depending on the organ involvement. No GeneXpert-positive cases (PTB and EPTB) showed resistance to rifampicin. There were no cases of disseminated TB.

2.3. Referral to psychiatric facilities

If the GAD-7, PHQ-9 or PSS-10 scores were found to lie in the severe category at any stage of assessment, the patients were referred to the department of psychiatry of the institute for further evaluation & management.

2.4. Data analysis

The data analysis was carried out by the licensed version of the IBM SPSS Statistics for Windows version 25.0 (Armonk, NY: IBM Corp.) Descriptive statistics, such as mean, median, frequency (%) were used to represent the socio-demographic, clinical profiles, and psychological parameters of the participants. Comparison of the psychological parameters before and after the intensive phase of the treatment was conducted using paired *t*-test (for normally distributed data) or Wilcoxon signed rank test (for non-normally distributed data as established by Shapiro-Wilk test: $p < 0.05$). Data of only those participants were analysed whose information at both time points were available. A test of significance was kept at p value < 0.05.

3. Results

Overall, 50 patients were approached for data collection; however, four potential participants did not give consent, hence at the baseline we had 46 participants. Out of 46 participants, six were excluded: four were non adherent to medications, and two were lost to follow up. Consequently, data of 40 participants was available for final analysis.

3.1. Baseline characteristics

The mean age of study participants was 31.65 (±10.38) years, belonging mostly to early adulthood and middle-aged groups. The gender distribution was equal (20 participants of each). The mean body mass index was 21.69(±3.02) kg/m^2, falling in the normal weight category. Twenty-five participants (62.5%) were married. Most participants lied in above the poverty line (APL) category (28,70%) and resided in urban regions (29,72.5%). The prevalence of tobacco and alcohol consumption was low (n = 15, 37.5% and n = 13, 32.5%, respectively) (Table 1).

The study was overrepresented by EPTB participants, with as high as 31 (77.5%) had EPTB while only nine participants (22.5%) had PTB and. Lymph node TB accounted for 13 (32.5%) of the EPTB subjects. Further details are shown in Table 2. None of the participants reported comorbidities of hypertension, diabetes mellitus or chronic kidney or liver disease.

Table 1
Sociodemographic profile of the participants.

Characteristics		N (%)
Age in years (Mean ± SD)		31.65 ± 10.38
Sex	Female	20 (50)
	Male	20 (50)
BMI in kg/m^2 (Mean ± SD)		21.69 ± 3.02
Marital status	Married	25 (62.5)
	Unmarried	15 (37.5)
Socioeconomic status	APL	28 (70)
	BPL	12 (30)
Region	Urban	29 (72.5)
	Rural	11 (27.5)
Tobacco usage	Uses Tobacco	15 (37.5)
	Does not use tobacco	25 (62.5)
Alcohol intake	Consume Alcohol	13 (32.5)
	Does not consume alcohol	27 (67.5)

BMI= Body Mass Index, APL = Above Poverty Line, BPL=Below Poverty Line.

Table 2
Clinical diagnosis of the Participants.

S.No.	Type of TB	Area Involved		N (%)
1.	EPTB			Total = 31(77.5)
		Lymph node		13 (32.5)
		Others		16 (40)
			Ocular	1 (2.5)
			Pott's spine	3 (7.5)
			Koch's abdomen	3 (7.5)
			Pleural effusion	2 (5)
			Skin	2 (5)
			Meningitis	2 (5)
			Breast	1 (2.5)
			Joint	1 (2.5)
2.	PTB			9 (22.5)

EPTB = Extra-Pulmonary Tuberculosis, PTB= Pulmonary Tuberculosis.

3.2. Findings of baseline psychological parameters and QoL of the participants

The details of mean (standard deviation) and median (interquartile difference [IQR]) scores on PHQ-9, GAD-7 and PSS-10 in the two visits are provided in Table 3.

At the time of diagnosis, 13 (32.5%) participants had moderate or more depression, among which four (10%) had severe depression. At baseline, moderate or more severe anxiety was present in 26 (65%) participants, among them nine (22.5%) had severe anxiety. Similarly, 26 (65%) participants experienced moderate or more stress. Notably, 12 (30%) had comorbid anxiety and depression. The mean scores of the WHO-QoL-BREF domains at the baseline were low, with lowest score seen in the psychological domain (48.99 ± 16.66). The details of the psychological parameters along with the quality-of-life scores for various domains of the participants are given in Table 3.

3.3. Findings of change in psychological parameters and QoL of the participants post-intensive therapy

Overall, a decrease in the mean scores of depression, anxiety and stress found at the follow-up as compared to baseline; however, this difference was statistically significant only for anxiety and depression ($Z = -2.271$, $p = 0.023$ and $Z = -2.093$, $p = 0.036$, respectively), as tested by Wilcoxon signed rank test.

Furthermore, the mean score of WHO-QoL-BREF psychological domain at baseline was 48.99 (±16.66), the least among all domains. There was improvement in median scores across all domains (physical, psychological, social and environmental) in the second visit; however, this difference did not attain statistical significance.

Table 3
Descriptive Analysis of Psychological Parameters of Participants before and after intensive phase of treatment.

S. No.	Psychological Parameter		Before treatment- n (%)/mean (SD)	After intensive phase of therapy- n (%)/mean (SD)	Statistical Value
1.	Depression				
		Minimal	11 (27.5)	17 (42.5)	
		Mild	16 (40)	13 (32.5)	
		Moderate	5 (12.5)	6 (15)	
		Moderately severe	4 (10)	2 (5)	
		Severe	4 (10)	2 (5)	
		Median	7.00	5.50	$Z = -2.27$, $p = 0.02$
2.	Anxiety				
		Minimal	0 (0)	7 (17.5)	
		Mild	14 (35)	11 (27.5)	
		Moderate	17 (42.5)	13 (32.5)	
		Severe	9 (22.5)	9 (22.5)	
		Median	11.00	10.00	$Z = -2.09$, $p = 0.03$
3.	Stress				
		Mild	14 (35)	15 (37.5)	
		Moderate	22 (55)	22 (55)	
		High	4 (10)	3 (7.5)	
		Mean score (Mean ± SD)	15.30 ± 6.341	15.30 ± 6.548	$t = 0.0$, $p = 1$ (CI = −1.7 – 1.7)
4.	Quality of Life				
		Physical	62.23 ± 14.77	62.95 ± 16.027	$t = -0.89$, $p = 0.38$ (CI = −2.3–0.9)
		Psychological	48.92 ± 16.65	49.29 ± 15.832	$t = -0.48$, $p = 0.62$ (CI = −1.8 – 1.1)
		Social	62.08 ± 22.004	61.25 ± 21.809	$t = 0.84$, $p = 0.4$ (CI = −1.2 – 2.8)
		Environmental	60.94 ± 17.748	61.41 ± 18.174	$t = -0.46$, $p = 0.64$ (CI = −2.5 – 1.5)

4. Discussion

The primary aim of this study was to assess the psychological health of TB patients (both extra-pulmonary and pulmonary) at diagnosis and to evaluate how these health conditions changed after the intensive phase of TB treatment. We also investigated whether anti-tubercular therapy alone is sufficient to bring about an improvement in various domains of the quality of life of persons suffering from TB, or if additional psychological interventions or wellbeing measures are indicated.

To best of our knowledge, the current research is among limited prospective research on psychological status of individuals receiving anti-TB treatment, thus, informing us whether disease resolution leads to improvements in psychological health and QoL, apart from physical health. Notably, existing research on this topic predominantly involves individuals with pulmonary tuberculosis. Therefore, our study intended to comprise at least half if not less extrapulmonary TB who had varying clinical progression depending on the affected organ. Strikingly, the current study was overrepresented by the extra-pulmonary TB patients, who were recruited through convenience sampling method with consecutive 50 participants were approached for the study; therefore, a meaningful comparison between the two conventional groups of the TB population, which was initially intended, could not be performed.

Our findings at baseline indicated that about one-third of participants experienced at least moderate depression, with 10% reporting severe depression. This prevalence aligns with studies from Southern and Eastern Ethiopia, which reported depression rates of ranging from 43.4% to over 50%.[24,25] The elevated depression levels in TB patients can be attributed to the social stigma associated with TB, lack of family support, socio-occupational dysfunction, complex treatment regimens and adverse drug reactions, in addition to the health challenges posed by the disease.[26–28] High depression rates among TB patients are critical as they not only adversely affect medication adherence,[29] but also lead to severe depression-related outcomes, including suicide, a major public health problem. Above findings underscore the importance of psychological assessment and intervention in persons with TB.[30]

As high as 65% of participants reported moderate or higher anxiety levels, with 22.5% experiencing severe anxiety. Again this prevalence is in accordance with the cross-sectional studies from Ethiopia[24] and northern part of India[31] (40% and 50%, respectively). Anxiety has been shown to adversely affect the course of pulmonary diseases, emphasizing the need for basic non-pharmacological interventions, such as relaxation exercises, empathetic listening, cognitive restructuring to address anxiety in TB patients; such interventions can be readily delivered by the physician if trained adequately.[32]

Similarly, nearly two-thirds of participants reported moderate or higher stress levels, consistent with a study in Northeast China that found high psychological distress in TB patients. Research shows that stress can negatively impact behaviour (unhealthy choices, sleep issues, medication non-adherence) and has biological underpinning (increased inflammation, Hypothalamus-Pituitary-Adrenal axis disruption) for adverse outcomes in individuals suffering from TB, like loss of follow-up and mortality.[29,32] Hence, stress-reduction techniques like mindfulness meditation, positive coping techniques, problem solving, etc.[33] must be utilized for alleviating psychological stress of such individuals.

The findings of our study, which predominantly comprised extra-pulmonary TB patients, are concordant with available literature on this topic primarily involving pulmonary TB patients, underscores that probably the psychological impact of the TB is similar in pulmonary and extra-pulmonary TB. However, the limited sample size of the study and skewed distribution of the study participants restrict us from making any firm conclusions. More research is required elucidate this observation.

Quality of life (HRQoL) in all domains—physical, physiological, environmental health, and social relationships—was poor at baseline, which is consistent with previous studies. However, the psychological domain was the most affected in our sample, differing from studies in country of southeast Asia[34] and South Africa[35] where the effect on physical domain was predominant. This difference in finding may be attributed to higher prevalence and severity of the psychological issues (anxiety, depression, stress) in our participants or, more importantly, the limited sample size of our study, which might have led to inaccurate result (higher type-1 error). Though improvements in HRQoL on follow up are seen during standard anti-TB therapy, some patients continue to experience residual impairment,[12] highlighting the importance of considering HRQoL, including psychological aspects, in TB research and

programs evaluation studies.

Upon completing the intensive phase, we observed significant improvements in anxiety and depression symptoms among our study participants. However, there was no corresponding improvement in quality of life or a reduction in stress levels. In contrast, a study in southern India[36] reported improvements in all quality-of-life domains, raising questions about the discrepancy between mental health improvements and the psychological domain of quality of life. Upon closer examination, we discovered that certain items related to sleep and appetite in the PHQ-9 and sleep in the GAD-7 were affected by the clinical manifestations of the disease and improved as the disease resolved. These factors had an impact at both the baseline and follow-up assessments, contributing to improved scores. However, the lack of significant improvement in the psychological domain of HRQoL, suggests that the improvement in these scales may primarily result from improvements in physical health, casting doubt on whether psychological health has genuinely improved. Future research can use hospital anxiety and depression scale (HADS) to overcome this assessment tool-related issues.

In our study, psychiatry evaluation was indicated in 25 patients (62.5%) who were also referred to the psychiatry out-patient facility of the institute; however, none of them actually visited the psychiatry department, highlighting a poor mental health help seeking. Efforts should hence, be made for on-site psychological support, may be by involving a clinical psychologist and psychiatrist in DOTS centre, itself to address the psychological comorbidities of the patients. One study from southern part of India found significant improvements in psychological measures in patients referred for psychiatric evaluation and treatment, highlighting the importance of psychological intervention in enhancing the overall health of TB patients. This aligns with the principles and the importance of consultation liaison psychiatry for TB patients.[37]

Our study has some key strengths, including being the first in Central India – a region with its own unique culture and social factors (e.g., stigma) associated with TB. Study participants comprising a substantial proportion of extrapulmonary TB patients, contributing unique insights into this research-wise underrepresented population. Furthermore, the longitudinal design provided valuable insights into treatment effects on psychological variables and quality of life, an improvement over previous studies that consider only the prevalence of psychological problems at baseline. Using questionnaires and in-person interviews improved the study's reliability compared to previous studies relying solely on patient self-reports.

Importantly, our study also had certain noteworthy limitations. Firstly, we used convenience sampling technique with consecutive enrolees of the DOTS centre becoming the participants of the present study. This sampling method, however, left us with overrepresented EPTB population; therefore, we could not make a comparison between the EPTB and PTB participants.

Secondly, the limited sample size of the study precluded us from drawing any firm conclusions as this might have resulted in type-1 error (i.e., inaccurate result); moreover, the universe of the study being a single tertiary-care hospital raises generalizability issues. Thirdly, due to logistic issues, our follow-up data was limited to the intensive phase of the treatment; hence, long-term course and outcome of the psychological and QoL parameters could not be assessed. Lastly, we used GAD-7 and PHQ-9 as screening tools to assess the anxiety and depression, respectively, that are likely to get influenced by biological and somatic symptoms of the TB; in contrast, instruments such as Hospital Anxiety and Depression Scale (HADS) or Montgomery and Asberg Depression Rating Scale (MADRS) which covers more core symptoms of the respective psychiatric conditions would have been more accurate.

Future research must build on this limitation by involving larger number of participants, preferably with a multi-centric study universe, to evaluate the differences in the psychological parameters and QoL between pulmonary and extrapulmonary TB patients, using outcome measures that are less influenced by the physical aspects of the TB and following the patients till the end of the maintenance phase of treatment to elucidate the sustenance of improvement or end-of-treatment psychological state of the TB patients.

5. Conclusion

Our study highlights the high prevalence of depression, anxiety, stress, and poor HRQoL among TB patients. We found that the extent and severity of psychological impact of the TB in EPTB is similar to PTB, as shown in the literature, albeit with some methodological limitations. Following intensive phase of therapy, severity of depression and anxiety reduced significantly; however, change in stress-level and QoL remained non-significant. Above findings underscores the importance of having a multi-disciplinary team involving mental health professionals or consultation liaison psychiatrist, social worker, a pulmonologist or infectious disease experts in care for persons with TB. The current work emphasizes the need of baseline psychological screenings of individuals diagnosed with TB and offering psychiatric evaluation and support to those experiencing significant distress. This holistic, multi-disciplinary approach is likely to substantially improve the health and quality of life for TB patients.

Conflicts of interest

There are no conflicts of interest.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Comparison of treatment adherence among TB patients with and without COVID-19 in South India

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ABSTRACT

Aim: The present study aimed to compare the adherence to anti-TB treatment among post-COVID-19 pulmonary TB cases and TB patients without a history of COVID-19 in South India.
Methods: A prospective, cross sectional study was conducted in all drug-sensitive pulmonary tuberculosis patients in National TB Elimination Program. The research investigates the impact of the COVID-19 pandemic on TB management, considering both subjective and objective measures of adherence. Data were collected using a validated instrument for subjective assessment and urine metabolite testing for objective evaluation.
Results: The results reveal significant differences ($p < 0.05$) between subjective and objective adherence measures, emphasizing the need for accurate and comprehensive assessment methods. However, there is no statistically significant difference ($p > 0.05$) in adherence to anti-TB treatment among post-COVID-19 pulmonary TB cases and TB patients without a history of COVID-19 in South India. The reason for non-adherence in both groups were ATT side effects, loss of daily wages, forgetting to take medication and lazy to take medications.
Conclusion: The study concluded that there is no statistically significant difference ($p > 0.05$) in adherence to anti-TB treatment among post-COVID-19 pulmonary TB cases and TB patients without a history of COVID-19.

1. Introduction

Tuberculosis (TB) and COVID-19, both formidable respiratory diseases, pose significant challenges to global public health. The coexistence of these two pandemics raises complex questions about the impact of COVID-19 on the management of TB, specifically concerning the adherence to anti-TB treatment regimens.[1] This research focuses on post-COVID-19 pulmonary TB cases, comparing their treatment adherence with TB patients without a history of COVID-19 in the context of the National Tuberculosis Elimination Program (NTEP) in South India.[2] Through a dual-method approach incorporating subjective and objective measures, this study aims to contribute valuable insights to enhance our understanding of the challenges posed by the intersection of these two diseases.

1.1. Contextualizing the dual burden of TB and COVID-19

TB, caused by Mycobacterium tuberculosis, remains a persistent global health challenge. Despite significant strides in diagnosis and treatment, TB continues to be a leading cause of morbidity and mortality, especially in regions with limited resources.[1] The emergence of the COVID-19 pandemic has added a layer of complexity to TB management, with disruptions observed across the entire spectrum of TB services South India,[2] with its high burden of TB cases, provides a pertinent setting to explore the intricate dynamics of these dual respiratory burdens.

1.2. Impact of COVID-19 on TB services

Studies have highlighted the substantial disruptions in TB services attributable to the COVID-19 pandemic, ranging from decreased TB case detection to challenges in patient care and treatment.[3,4] The

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vulnerability of individuals with pre-existing respiratory conditions, including TB, to severe outcomes from COVID-19 further underscores the urgency of understanding the consequences of this dual burden.[5,6]

1.3. The need for comprehensive adherence studies

Treatment adherence stands as a pivotal factor in the successful management of both TB and COVID-19. Adherence challenges may be amplified in post-COVID-19 pulmonary TB cases, where individuals grapple with the complexities of managing two respiratory illnesses concurrently. While subjective measures, such as patient-reported experiences, perceptions, and attitudes, provide qualitative insights, objective measures encompassing clinical data and medication adherence records offer a quantitative understanding of treatment adherence dynamics. Adherence as reported by the patients is unreliable, and urine testing could be used in routine care to assess adherence.[7]

1.4. Significance of the study

By elucidating the challenges faced by individuals managing both TB and COVID-19, this study seeks to contribute nuanced insights to the existing literature. The findings aspire to inform evidence-based strategies that can enhance treatment adherence and optimize TB control efforts, particularly in the post-pandemic era.

1.5. Objectives of the study

This research aims to conduct a comparative analysis of adherence to anti-TB treatment among post-COVID-19 pulmonary TB cases and TB patients without a history of COVID-19 in South India. The study will explore subjective measures to comprehend patient experiences and perceptions, coupled with objective measures including clinical data, medication adherence records, and treatment outcomes.

2. Methods

2.1. Study design

A comparative, cross-sectional study was conducted within the framework of the National Tuberculosis Elimination Program (NTEP) Government General Hospital, Ananthapuramu which is a part of NTEP network in South India. The study was conducted for a period of 8 months from March 2023 to October 2023. This study was approved by the Institutional Ethics Committee of Balaji College of Pharmacy, Ananthapuramu (IEC clearance No. IRB/BCP-PP-08/20).

2.2. Selection criteria

All drug-sensitive pulmonary tuberculosis outpatients over the age of 18, who had been receiving TB treatment for at least a month prior to the study's commencement were included. Patients with renal or hepatic disease, drug-resistant tuberculosis, and pregnant women whose conditions might require a modification of the standard TB dosage regimen were excluded. Individuals with drug-sensitive tuberculosis who were in critical condition as well as those with insufficient data in their case notes were not included. Written informed consent was obtained from all the eligible patients.

2.3. Study procedure

As per our medical records data, we had 145 TB patients with COVID-19. So the study team decided to collect the same number of (i.e. 145) TB patients without COVID-19, so as to have even sample distribution between the groups. This distribution ensured a balanced representation of both groups for a robust comparative analysis of treatment adherence.

Both TB patients with and without COVID-19 are registered in NTEP and were given 1-month anti-TB drugs based on NTEP standard treatment protocol. They were interviewed to collect socio-demographic details, ATT adherence, non-adherence reasons to ATT, using validated instruments. NTEP centres i.e., GGH, NTEP centre Ananthapuramu and NTEP centre, Bathalapalli TB patients are included in the study.

2.4. Data collection

A specially designed data collection form was used to record the patient's demographic data, including age, gender, smoking status, alcohol use, education, occupation, HIV status, diabetic status, category of tuberculosis, and past and current medical and medication history, after written informed consent was obtained for both TB patients with and without COVID-19. The modified Kuppuswamy socioeconomic scale was used to determine the patient's socioeconomic class (SEC).[8] The patient's level of adherence, course of treatment, potential cause(s) of non-adherence, and details regarding adverse reactions to ATT were also gathered. Clinical data was obtained from electronic case sheets and medical records for the subjects.

2.5. Subjective adherence measure

The Medication Adherence Report Scale (MARS) was used to evaluate the patient's medication adherence. The MARS-10 scale was chosen by the research team because it is simple to use. This instrument was created by Chan et al.[9] and has been extensively utilized in research on a range of chronic conditions, including diabetes mellitus, hypertension, and chronic obstructive pulmonary disease.[10] A higher score on the MARS total score indicated better medication adherence. The scores ranged from 0 to 10.

2.6. Objective adherence measure

When patients came back to the hospital a month later to pick up their prescriptions, urine samples were taken. Using High Performance Liquid Chromatography (HPLC), an analytical method was developed and validated based on the literature[11,12] to detect the presence of ATT or its metabolite. The HPLC condition was optimized (supplementary material). If ATT or its metabolite was found by the HPLC, the patient was labelled as "adherent," and if neither was found, the patient was labelled as "non-adherent."

2.7. Statistical analysis

All collected data were entered into MS excel and analysed with Epi Info Version 7.2.2.6. Data were expressed in frequency, percentage, and 95% confidence intervals (CIs). 95% CI was calculated using multiple logistic regression analysis by using SPSS version 24.0. Bivariate associations between subjective and objective adherence was calculated by using chi-square tests. $p < 0.05$ was considered statistically significant.

3. Results

3.1. Socio-demographic details

The socio-demographic and baseline characteristics of study patients are shown in Table 1. 122 patients (42%) were aged between 30 and 50 years and 161 patients (56%) were female, 192 (66%) were non-smokers, 195 (67%) were non-alcoholic and 150 patients (52%) belonged to upper-lower socio-economic class.

3.2. Comparison of MARS versus HPLC data in patients with Covid-19

A comparison of the MARS scale results with the HPLC results revealed that only 80 patients (55.17%) were ATT adherents, despite the

Table 1
Demographic characteristics of study participants.

Variable	Patients with COVID-19 (N = 145)	Patients without COVID-19 (N = 145)	Overall (N = 290)
Age (years)			
<30	32 (22.06)	21 (14.48)	53 (18.3)
30–50	67 (46.21)	55 (37.93)	122 (42.1)
>50	46 (31.72)	69 (47.59)	115 (39.6)
Gender			
Male	78 (53.7)	83 (57.3)	161 (55.6)
Female	67 (46.3)	62 (42.7)	129 (44.4)
Smoking status			
Non-smokers	98 (67.58)	94 (64.83)	192 (66.2)
Smokers	47 (32.42)	51 (35.17)	98 (33.8)
Alcohol use			
Alcoholic	45 (31.04)	50 (34.48)	95 (32.8)
Non-alcoholic	100 (68.96)	95 (65.52)	195 (67.2)
Education			
Illiterate	59 (40.69)	47 (32.41)	106 (36.55)
Literate	86 (59.31)	98 (67.59)	184 (63.45)
Occupation			
Employed	38 (26.21)	54 (37.24)	92 (31.72)
Unemployed[a]	107 (73.79)	91 (62.76)	198 (68.28)
HIV			
Positive	24 (16.55)	14 (9.66)	38 (13.10)
Negative	121 (83.45)	131 (90.34)	252 (86.90)
Diabetic			
Yes	48 (33.11)	35 (24.14)	83 (28.63)
No	97 (66.89)	110 (75.86)	207 (71.37)
Category of TB			
New	38 (26.21)	43 (29.66)	81 (27.93)
Previously treated	107 (73.79)	102 (70.34)	209 (72.07)
Socio-economic class[b]			
Upper	2 (1.37)	2 (1.38)	4 (1.37)
Upper middle	10 (6.90)	12 (8.27)	22 (7.58)
Lower middle	35 (24.15)	40 (27.58)	75 (25.86)
Upper lower	80 (55.17)	70 (48.29)	150 (51.73)
Lower	18 (12.41)	21 (14.48)	39 (13.46)

Values presented as n (%); HIV, human immunodeficiency virus; TB, tuberculosis.

[a] Unemployed individuals are those who are of working age, willing and able to work, actively seeking employment, but unable to find suitable employment opportunities.

[b] According to modified Kuppuswamy socioeconomic scale.

fact that 89 patients (61.37%) claimed to be. There exists a noteworthy statistically significant variation ($p < 0.05$) between the subjective and objective measures of ATT adherence.

3.3. Comparison of MARS versus HPLC data in patients without Covid-19

Although 86 patients (59.31%) who used the MARS scale claimed to be ATT adherents, the HPLC results showed that only 81 patients (55.86%) were. When comparing subjective and objective measures of ATT adherence, there is a statistically significant ($p < 0.05$) noteworthy variation Table 2.

3.4. Determinants of adherence using subjective data in patients with Covid-19

Subjective and objective data showed a relationship between patient characteristics and adherence (Table 2) (see Table 3). Patients were categorized as adherent and non-adherent based on their MARS score. Adherent was the outcome variable among these two.

In terms of adherence versus non-adherence, patients under 30 had a 22.47% lower likelihood of adhering, whereas patients between the ages of 30 and 50 had a 48.32% lower likelihood. Patients with a job had a 24.71% lower adherent rate, while non-smokers had a 2.9 times higher adherent rate. Patients in lower-middle SEC had an adherent rate 4.5 times higher than those in upper-middle SEC.

3.5. Determinants of adherence using objective data in patients with Covid-19

The presence of ATT or its metabolite was found using the HPLC method. Patients were categorized as adherent or non-adherent based on the presence of the drug or its metabolite. Patients under 30 had a 21.25 % of adherence, while those between 30 and 50 years old had a 47.50% adherence. Patients with unemployment were 1.6 times more likely to adherent than non-smokers, who were 70.77%.HIV Negative patients are 6.2 times more adherence than patients with HIV Positive.

3.6. Determinants of adherence using subjective data in patients without Covid-19

A correlation between patient characteristics and adherence was demonstrated by both subjective and objective data (Table 2). The MARS score was used to classify patients as adherent or non-adherent. When comparing adherence to non-adherence, patients under 30 were less likely to adhere (13.95%), while patients between 30 and 50 were less likely to adhere (37.21%). The adherent rate was 65.12% for non-smokers and 62.79% for patients who were Unemployed. The adherent rate among patients in lower-middle SEC was 3.6 times higher than that of patients in upper-middle SEC.

3.7. Determinants of adherence using objective data in patients without Covid-19

The HPLC method was utilized to detect the existence of ATT or its metabolite. Depending on whether the medication or one of its metabolites was present, patients were classified as adherent or non-adherent. Patients under 30 exhibited an adherence rate of 16.05%, whereas patients aged 30 to 50 exhibited an adherence rate of 37.04%. Patients who were employed had an adherence rate of 1.7 times higher than that of non-smokers (65.63%). Patients without HIV adhere to treatment 9.2 times more frequently compared to people with HIV (see Table 4).

3.8. Reasons for non-adherence to ATT in patients with Covid-19

Even though the medications were given away for free, many patients were unable to follow their treatment plan for a variety of reasons. The most often cited reasons were ATT side effects (23.50%), loss of daily wages (10.74%), forgetting to take medication and lazy to take medications (9.17%). About 6.93% of the subjects stated long duration of treatment, and (8.95%) fear of side effects as reasons for non-adherence (Table 5).

Table 2
Comparison of subjective and objective adherence measures to ATT in.

	Subjective assessment		Objective assessment		$X,^2$ (*p*-value)
	Patients With COVID-19	Patients Without COVID-19	Patients With COVID-19	Patients Without COVID-19	
Adherent	89 (61.37)	86 (59.31)	80 (55.17)	81 (55.86)	10.5
Non-adherent	56 (38.63)	59 (40.69)	65 (44.83)	64 (44.14)	($p < 0.05$*)

Values presented as n (%) unless defined otherwise; ATT, anti-tubercular treatment.

Table 3
Association between patient characteristics and adherence in Patients with COVID -19.

Variable	Subjective measure			Objective measure		
	Adherent	Non-adherent	X^2 (p-value)	Adherent	Non-adherent	X^2 (p-value)
Age (years)						
<30	20 (22.47)	12 (21.43)	34.6 ($p < 0.05$*)	17 (21.25)	15 (23.07)	32.9 ($p < 0.05$*)
30–50	43 (48.32)	24 (42.85)		38 (47.50)	29 (44.62)	
>50	26 (29.21)	20 (35.72)		25 (31.25)	21 (32.31)	
Gender						
Male	46 (51.68)	32 (57.14)	1.8 ($p > 0.05$)	49 (61.25)	31 (47.69)	1.1 ($p > 0.05$)
Female	43 (48.32)	24 (42.85)		31 (38.75)	34 (52.31)	
Smoking status						
Non-smokers	62 (69.66)	36 (64.28)	20.3	52 (65.00)	46 (70.77)	13.0 ($p < 0.05$*)
Smokers	27 (30.34)	20 (35.72)	($p < 0.05$*)	28 (35.00)	19 (29.23)	
Alcohol use						
Alcoholic	30 (33.70)	15 (26.78)	1.7 ($p > 0.05$)	25 (31.25)	20 (30.77)	0.6 ($p > 0.05$)
Non-alcoholic	59 (66.30)	41 (73.22)		55 (68.75)	45 (69.23)	
Education						
Illiterate	42 (47.19)	17 (30.36)	4.6 ($p > 0.05$)	31 (38.75)	28 (43.08)	0.4 ($p > 0.05$)
Literate	47 (52.81)	39 (69.64)		49 (61.25)	37 (56.92)	
Occupation						
Employed	22 (24.71)	16 (28.57)	11.2 ($p < 0.05$*)	20 (25.00)	18 (27.69)	4.7 ($p < 0.05$*)
Unemployed	67 (75.29)	40 (71.43)		60 (75.00)	47 (72.31)	
HIV						
Positive	10 (11.24)	14 (25.00)	3.7 ($p > 0.05$)	11 (13.75)	13 (20.00)	1.8 ($p > 0.05$)
Negative	79 (88.76)	42 (75.00)		69 (86.25)	52 (80.00)	
Diabetic						
Yes	27 (30.34)	21 (37.50)	2.6 ($p > 0.05$)	26 (32.50)	22 (33.85)	3.8 ($p > 0.05$)
No	62 (69.66)	35 (62.50)		54 (67.50)	43 (66.15)	
Category of TB						
New	23 (25.84)	15 (26.78)	1.1 ($p > 0.05$)	20 (25.00)	18 (27.69)	0.5 ($p > 0.05$)
Previously treated	66 (74.16)	41 (73.22)		60 (75.00)	47 (72.31)	
Socio-economic class						
Upper	1 (1.12)	1 (1.79)	15.0 ($p > 0.05$)	2 (2.50)	0 (0.00)	3.1 ($p > 0.05$)
Upper middle	7 (7.87)	3 (5.36)		7 (8.75)	3 (4.62)	
Lower middle	25 (28.09)	10 (17.85)		20 (25.00)	15 (23.07)	
Upper lower	46 (51.68)	34 (60.71)		41 (51.25)	39 (60.00)	
Lower	10 (11.24)	08 (14.29)		10 (12.50)	08 (12.31)	

Values presented as n(%) unless defined otherwise; HIV, human immunodeficiency virus; TB, tuberculosis.

3.9. Reasons for non-adherence to ATT in patients without Covid-19

Many patients were unable to adhere to their treatment plan for a variety of reasons, despite the fact that the medications were provided free of charge. ATT side effects (24.40%), loss of daily wages (10.98%), (9.89%) forgetting to take medication, and being too lazy to take medication (9.45%) were the most frequently mentioned reasons. Table-5 shows that 9.24% of the subjects reported fear of side effects, and 7.25% of the subjects cited the length of their treatment as reasons for non-adherence.

4. Discussion

To the best of our understanding, this study represents the inaugural attempt to compare and document the adherence levels in tuberculosis patients who diagnosed with COVID-19 and without COVID-19. This comparative analysis of clinical variables among individuals diagnosed with TB during the COVID-19 pandemic, juxtaposed with the need of adherence. This research brings to light significant modifications in the clinical care provided to TB patients in the context of the COVID-19 pandemic.

In 2014, India's National TB Elimination Program (NTEP) initiated a transition in the treatment approach for drug-susceptible TB patients, moving from a thrice-weekly dosing regimen to a daily medication dosing strategy. This transition was prompted by concerns regarding the increased burden imposed on patients who had to visit clinics daily, as opposed to thrice weekly. Consequently, the NTEP shifted its focus away from directly observed treatment, short-course (DOTS) and moved towards the adoption of self-administered therapy (SAT), where patients take medication independently, or monitoring through the utilization of 99DOTS.

Amid the COVID-19 pandemic, there has been a reallocation of both human and economic health resources, primarily driven by the heightened priority accorded to managing this infectious disease. This reallocation has led to disruptions in the diagnosis and treatment of various health conditions.[13] Moreover, the pandemic has significantly impacted community-based disease prevention and health promotion programs across several countries.[14] In the context of our study by employing both subjective and objective measures, researchers can gain a better understanding of patient adherence behaviours and the factors influencing non-adherence. Such insights are crucial for optimizing TB treatment programs and ensuring the effectiveness of the NTEP in achieving its goals of TB elimination in India.

The findings of this study shed light on the adherence to anti-tuberculosis (TB) treatment among two distinct groups: post-COVID-19 pulmonary TB cases and TB patients without a history of COVID-19 in South India. The adherence is slightly on higher side in patients who suffered with COVID-19 (61.37%) when compared to patients who didn't suffer (59.31%). These results are similar to Lippincott C et al.,[15] which reveals 65% adherence in tuberculosis patients.

In the assessment of urine colour among tuberculosis (TB) patients who underwent anti-tuberculosis treatment (ATT) compared to those who did not, a distinct pinkish/orange discoloration indicative of Rifampicin intake served as an initial visual cue for treatment adherence. However, the reliability of this observation was compromised, as discoloured urine could also result from various medications (such as multivitamins, nitrofurantoin, etc.), specific foods, or food dyes. Consequently, this visual cue could not be singularly relied upon as a definitive indicator of treatment adherence.

In order to ascertain the adherence rate within this study, a

Table 4
Association between patient characteristics and adherence in Patients without COVID -19.

Variable	Subjective measure			Objective measure		
	Adherent	Non-adherent	X^2 (p-value)	Adherent	Non-adherent	X^2 (p-value)
Age (years)						
<30	12 (13.95)	09 (15.25)	34.6	13 (16.05)	08 (12.50)	32.9
30–50	32 (37.21)	23 (38.98)	($p < 0.05$*)	30 (37.04)	25 (39.06)	($p < 0.05$*)
>50	42 (48.84)	27 (45.76)		38 (46.91)	31 (48.44)	
Gender						
Male	48 (55.81)	35 (59.32)	1.8	44 (54.32)	39 (60.94)	1.1
Female	38 (44.19)	24 (40.68)	($p > 0.05$)	37 (45.68)	25 (39.06)	($p > 0.05$)
Smoking status						
Non-smokers	56 (65.12)	38 (64.40)	20.3	52 (64.20)	42 (65.63)	13.0
Smokers	30 (34.88)	21 (35.60)	($p < 0.05$*)	29 (35.80)	22 (34.37)	($p < 0.05$*)
Alcohol use						
Alcoholic	29 (33.72)	21 (35.60)	1.7	30 (37.04)	20 (31.25)	0.6
Non-alcoholic	57 (66.28)	38 (64.40)	($p > 0.05$)	51 (62.96)	44 (68.75)	($p > 0.05$)
Education						
Illiterate	26 (30.23)	21 (35.59)	4.6	24 (29.63)	23 (35.94)	0.4
Literate	60 (69.77)	38 (64.41)	($p > 0.05$)	57 (70.37)	41 (64.06)	($p > 0.05$)
Occupation						
Employed	32 (37.21)	22 (37.29)	11.2	30 (37.04)	24 (37.50)	4.7
Unemployed	54 (62.79)	37 (62.71)	($p < 0.05$*)	51 (62.96)	40 (62.50)	($p < 0.05$*)
HIV						
Positive	9 (10.46)	5 (8.47)	3.7	8 (9.88)	6 (9.37)	1.8
Negative	77 (89.54)	54 (91.53)	($p > 0.05$)	73 (90.12)	58 (90.63)	($p > 0.05$)
Diabetic						
Yes	20 (23.26)	15 (25.43)	2.6	21 (25.92)	14 (21.87)	3.8
No	66 (76.74)	44 (74.57)	($p > 0.05$)	60 (74.08)	50 (78.13)	($p > 0.05$)
Category of TB						
New	25 (29.07)	18 (30.51)	1.1	24 (29.63)	19 (29.69)	0.5
Previously treated	61 (70.93)	41 (64.49)	($p > 0.05$)	57 (70.37)	45 (70.31)	($p > 0.05$)
Socio-economic class						
Upper	1 (1.16)	1 (1.69)	15.0	2 (2.47)	0 (0.00)	3.1
Upper middle	7 (8.14)	5 (8.47)	($p > 0.05$)	6 (7.41)	6 (9.38)	($p > 0.05$)
Lower middle	25 (29.07)	15 (25.43)		21 (25.92)	19 (29.67)	
Upper lower	41 (47.68)	29 (49.15)		39 (48.15)	31 (48.45)	
Lower	12 (13.95)	09 (15.26)		13 (16.05)	08 (12.50)	

Values presented as n (%) unless defined otherwise; HIV, human immunodeficiency virus; TB, tuberculosis.

Table 5
Reasons for non-adherence to ATT and side effects experienced by Patients with COVID-19.

Reason(s)[a] for non-adherence (n = 447)	Patients with COVID-19	Patients without COVID-19
Experienced side effects*	105 (23.50)	111 (24.40)
Loss/missing of daily wages	48 (10.74)	50 (10.98)
Forget to take medicines	41 (9.17)	45 (9.89)
Lazy to take medicines	41 (9.17)	43 (9.45)
Treatment course is too long	31 (6.93)	33 (7.25)
Fear of medication side effects	40 (8.95)	42 (9.24)
Social stigma	42 (9.40)	28 (6.15)
Relived from symptoms and not necessary to continue medications	34 (7.62)	36 (7.92)
Too much medicines to take	23 (5.14)	25 (5.49)
Symptoms not relieved and drugs seem to be ineffective	12 (2.68)	11 (2.42)
Felt depressed	12 (2.68)	12 (2.64)
Inability to collect medicines	10 (2.22)	11 (2.42)
Reduced motivation	08 (1.80)	08 (1.75)
Others	105 (23.50)	111 (24.40)
*Side effect(s)[b] experienced		
Coloured urine	09 (8.57)	09 (8.11)
Yellowish eye	07 (6.67)	07 (6.31)
Increased heartbeat	09 (8.57)	09 (8.11)
Impaired vision	02 (1.90)	02 (1.81)
Tiredness	18 (17.15)	18 (16.21)
Allergic skin reactions	09 (8.57)	10 (9.00)
Nausea and vomiting	35 (33.33)	39 (35.14)
Neuropathy signs	07 (6.67)	07 (6.31)
Increased appetite	09 (8.57)	10 (9.00)

Values presented as n (%); ATT, anti-tubercular treatment.
[a] Participants could report more than 1 reason for non-adherence to ATT.
[b] Participants could report more than 1 one side effect they experienced.

comprehensive approach involving both subjective and objective indicators was employed. This dual-method approach aimed to discern any disparities between patients' self-reported adherence and the actual objective measure of adherence.

In this current study, a dual-pronged approach was employed to evaluate treatment adherence, utilizing both subjective and objective measures. The subjective assessment involved the use of a validated instrument, while the objective measure consisted of urine metabolite testing. Notably, our findings unveiled a substantial disparity between the outcomes obtained through subjective and objective adherence testing.

This discrepancy underscores a critical concern regarding the monitoring of patient adherence to anti-tuberculosis treatment (ATT) within the National Tuberculosis Elimination Program (NTEP). The results suggest that relying solely on subjective assessments may not provide an accurate representation of patient adherence, prompting the recommendation for the integration of objective adherence testing methods.

Furthermore, the study highlights the potential advantages of incorporating urine testing into routine care practices. Beyond its relevance in research settings, urine testing emerges as a valuable tool for identifying patients at risk of suboptimal outcomes in the course of routine care. This dual role emphasizes the multifaceted utility of objective adherence testing, not only in research contexts but also in enhancing the precision of patient care within the framework of the NTEP.

The combination of a number of factors has been shown to influence patients' adherence to their drug regimens. In line with the findings of Suparna Bagchi et al.[16] several significant factors were identified as being associated with non-adherence to anti-tuberculosis treatment

(ATT). These factors included smoking, travel-related costs, alcohol consumption during treatment, and the unavailability of drugs at the health centre. These determinants underscore the multifaceted nature of challenges that may contribute to non-adherence, emphasizing the need for a comprehensive understanding of patients' circumstances beyond the treatment itself.

Similarly, the study conducted by Woimo et al.[17] unveiled predictors for ATT treatment non-adherence, expanding the scope to encompass factors such as knowledge, geographical distance, health information received at each visit, the burden of pill consumption, and the cost of medications other than ATT. The inclusion of these diverse predictors further emphasizes the complex interplay of variables influencing adherence and reinforces the importance of considering a broad spectrum of factors in designing interventions aimed at improving treatment adherence in tuberculosis patients.

The primary factors cited by patients in this study for non-adherence to anti-tuberculosis treatment (ATT) were consistent with those identified in previous research. The major reasons reported by patients included the adverse effects associated with ATT, financial constraints due to the loss or absence of daily wages, and forgetfulness in taking medications. This aligns with the findings of a study conducted by Subbaraman et al.[18]

Similarly, the study by Mekonnen et al.[19] also identified common themes regarding non-adherence, highlighting reasons such as forgetting to take medications, being preoccupied with other tasks, and being away from home or out of town. The convergence of these findings across different studies[20] emphasizes the recurring and impactful nature of certain determinants influencing non-adherence to ATT. Understanding these consistent patterns can inform targeted interventions aimed at addressing the identified barriers to adherence in tuberculosis treatment.

5. Limitations

We were unable to link 99DOTS adherence data with either subjective or objective adherence data of the present study.

6. Conclusion

A statistically significant difference exists between subjective and objective measures of ATT adherence. However, there is no discernible difference in adherence to anti-TB treatment among post-COVID-19 pulmonary TB cases and TB patients without a history of COVID-19 in South India. The study has highlighted the multifaceted challenges faced by TB patients in the wake of the COVID-19 pandemic, including disruptions to healthcare services, changes in treatment regimens, and organizational adjustments within TB units. These challenges, coupled with the identified reasons for non-adherence, such as side effects, financial constraints, and forgetfulness, underscore the need for targeted interventions and policy adaptations to optimize TB care in the evolving healthcare landscape.

Future prospective

Moving forward, future research endeavours should delve deeper into the long-term effects of the COVID-19 pandemic on TB management, exploring sustained adherence patterns and identifying effective interventions. Additionally, efforts should be directed towards bridging gaps in healthcare infrastructure and incorporating innovative technologies to facilitate remote monitoring and support for TB patients.

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Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.ijtb.2024.05.001.

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Cross-cultural reliability of Van Rie TB perceived Stigma Scale among TB survivors in North India

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ABSTRACT

Background: As India progresses towards TB elimination five years ahead of Sustainable Development Goals (SDG), Community-based perceptions of tuberculosis stigma become particularly relevant in the context of TB elimination efforts. This study aims to assess the cross-cultural reliability of 'Community Perspectives Van Rie TB Stigma Scale' which can been used for screening and rapid evaluation of prevalent stigma themes in community.
Methods: A community based cross-sectional study was conducted in North India among 400 TB survivors to assess the cross-cultural reliability of 'Community Perspective Van Rie TB stigma Scale'. Cronbach Alpha and McDonald's Omega were used for reliability analysis.
Results: Cronbach α value for the Van Rie TB Stigma Scale was 0.826 and McDonald's ω is 0.832 indicative of good reliability of the TB Stigma Scale.
Conclusion: The study is one the first studies to assess the cross-cultural reliability of Community Perspective of Van Rie TB Stigma Score in India. The reliability analysis indicates that the 'Community Perspectives Van Rie TB Stigma Scale' can be used in the Indian settings for screening of TB associated stigma.

1. Introduction

Tuberculosis (TB) is a chronic disease that has been one of the most common causes of communicable disease related morbidity and mortality worldwide. In 1993, TB was the first infectious disease to be declared a public health emergency by the World Health Organization (WHO). Tuberculosis as a disease is responsible for significant morbidity and mortality worldwide[1,2]

While public health initiatives and medical treatments have advanced one important factor that is occasionally overlooked is the effect of perceived stigma on TB-affected populations. For people with TB, stigma can have a significant effect on their treatment adherence, behaviours related to seeking medical attention, and general health outcomes.[3]

As Indian progresses towards TB elimination as part of National Strategic Plan for TB elimination through National Tuberculosis Elimination Programme (NTEP), five years ahead of Sustainable Development Goals (SDG), Community-based perceptions of tuberculosis stigma become particularly relevant in the context of TB elimination efforts.[4]

Stigma around tuberculosis is acknowledged as a major social predictor of health, and studies have shown how harmful it is to both individuals and communities. It has been a major obstacle to receiving and making use of necessary healthcare treatments, particularly the idea that the disease is linked to other retro-viral infections. This is particularly true for resource limited settings environment where vulnerable groups may be exposed to discrimination because of prevailing stigma.[5]

TB-related stigma can present in various forms, from simply refusing to eat with the diseased to shunning them from community and social events. For those who are affected, the stigma surrounding tuberculosis is quite real.[6,7]

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Table 1
Socio-demographic profile of study participants (N = 400).

Variable	Categories	Frequency	Percentage (%)
Gender	Male	257	64.3
	Female	143	35.8
Age (In Years)	18–45	228	57.0
	46–60	94	23.5
	>60	78	19.5
Locality	Urban	204	51.0
	Rural	196	49.0
Education	Illiterate	59	14.8
	Primary (5th)	53	13.3
	Middle (8th)	48	120
	High School (10th)	94	23.5
	Senior Secondary (12th)	78	19.5
	Graduate & above	68	17.0
Occupation	Unemployed	2	0.5
	Homemaker	93	23.3
	Student	58	14.5
	Government Employee	17	4.3
	Private Sector Employee	89	22.3
	Farmer	37	9.3
	Daily Wage Labourer	58	14.5
	Retired	46	11.5
Marital Status	Unmarried	58	14.5
	Married	342	84.5
Type of Family	Nuclear	174	43.5
	Joint	135	33.8
	Three Generation	91	22.8
Type of Tuberculosis	Pulmonary	368	92%
	Extra-Pulmonary	32	8%

Usually various qualitative methods are applied to assess stigma linked to tuberculosis, which often require trained investigators and the process in itself requires ample amount of time. This study conducted in North India, aims to assess the cross-cultural reliability of 'Community Perspectives Van Rie TB Stigma Scale' which is a structured scale used for screening and rapid evaluation of prevalent stigma themes in community, thereby helping in identifying areas which require a detailed exploratory evaluation.[8] The research aims to enable researchers involved in programmatic monitoring and evaluation to be able to identify problems hotspots early, ultimately aiding the goals for TB elimination.

2. Material & methods

This was a year-long community based cross-sectional study conducted in Rohtak District, Haryana. In Rohtak, urban and rural areas are covered under the 5 Tuberculosis unit (TU). In which TU's District Tuberculosis Centre (DTC) Rohtak and Government Hospital Rohtak provides services for urban Rohtak and TU Kalanaur, TU Meham and TU Sampla covering rural Rohtak.

The study included subjects who had had DS-TB (Drug Sensitive Tuberculosis) and had completed treatment for DS-TB as per NTEP guidelines from January 1, 2021 onwards registered on NIKSHAY portal and residing in Rohtak District were included in this study.

The study was initiated after obtaining necessary approval from Institution Ethics Committee (IEC). Line listing of treatment completed tuberculosis survivors residing in areas covered by Tuberculosis Units was obtained from District Tuberculosis Officer (DTO) of Rohtak District. Adult subjects (more than 18 completed years) who had had DST (Pulmonary or Extrapulmonary) having completed treatment from January 1, 2021 were included in the study.

Tuberculosis Patients on active treatment, having had drug resistance tuberculosis, any cases of prior relapse, treatment failure or return after default were excluded from the study.

As there are no prior studies on stigma levels among treatment completed tuberculosis survivors a baseline prevalence (P) of 50% stigma was considered, Q= (100-P) = 50%. Z value of 1.96 for 95% confidence level and 80% power of the study and an absolute error (D) of 5% and using the formulae. Sample size $N = Z^2 PQ/D2$, a sample size of 384 subjects was calculated. A total of 400 subjects were included in this study.

From the line listing obtained from the DTO, using Simple Random Sampling (SRS) using lottery method, subjects were identified. Each subject was traced in the field and visited by the investigator, the background of the study was explained to the study subject using a subject information sheet and a written informed consent was obtained from the volunteers who were willing to participate in the study. In case the subject was not available at the time of interview, two more visits were made. If the subjects were not available for interview in any of those three visits, the next individual in the line listing was traced till the sample size was completed.

A schedule containing semi-structured socio-demographic details, clinical details about the tuberculosis diseases and community-perceived Van Rie TB stigma 11-item Scale was administered to the subjects within one month of treatment completion.[8] The community perspective component of the scale has 11 items and is scored from Zero (0) to Three (3) with, zero indicating strong disagreement and three strong agreements.

Data was entered in Microsoft Excel and analysed using Jamovi 2.5.5. Cronbach α and McDonald's ω were used to assess the cross-cultural reliability of the scale in North India. Quantitative data was expressed in mean & standard deviation, quantitative. Qualitative data was expressed in proportions. A p-value less than 0.5 was considered statistically significant.

3. Results

The sociodemographic profile of study subjects as shown in Table 1, show that the majority of the TB survivors were male (64.3%), belonging to the age group of 18–45 years (57.0%), residing primarily in urban

Table 2
Proportionate responses for community based perceived stigma as per Van Rie TB Stigma Scale (N = 400).

Items	Score: 0	Score: 1	Score: 2	Score: 3
Item 1: Some people may not want to eat or drink with friends who have TB	43 (10.8)	126 (31.5)	203 (50.7)	28 (7)
Item 2. Some people feel uncomfortable about being near those with TB	106 (26.5)	100 (25.0)	172 (43)	22 (5.5)
Item 3. If a person has TB, some community members will behave differently towards that person for the rest of their life	193 (48.3)	105 (26.3)	58 (14.5)	44 (11.0)
Item 4. Some people do not want those with TB playing with their children	90 (22.5)	122 (30.5)	129 (32.5)	59 (14.8)
Item 5. Some people keep their distance from people with TB	138 (34.5)	45 (11.3)	160 (40.0)	57 (14.2)
Item 6. Some people think that those with TB are disgusting	133 (33.3)	76 (19.0)	118 (29.5)	73 (18.3)
Item 7. Some people do not want to talk to others with TB	156 (39.0)	90 (22.5)	124 (31.0)	30 (7.5)
Item 8. Some people are afraid of those with TB	223 (55.8)	42 (10.5)	107 (26.8)	28 (7.0)
Item 9. Some people try not to touch others with TB	98 (24.5)	97 (24.3)	161 (40.3)	44 (11.0)
Item 10. Some people may not want to eat or drink with relatives who have TB	65 (16.3)	122 (305)	122 (30.5)	91 (22.8)
Item 11. Some people prefer not to have those with TB living in their community	66 (16.5)	101 (25.3)	186 (46.5)	47 (11.8)

Table 3
Reliability analysis of Van Rie TB Stigma Scale and its psychometric properties.

	Mean (SD)	Cronbach's α	McDonald's ω	
Van Rie TB Stigma Scale	1.30 (0.614)	0.826	0.832	
Psychometric Properties	Item-Total Correlation	Cronbach's Alpha if Item Deleted	McDonald's Omega if Item is Deleted	p value
Item 1	0.516	0.812	0.817	<0.001
Item 2	0.555	0.807	0.813	<0.001
Item 3	0.487	0.812	0.822	<0.001
Item 4	0.565	0.805	0.813	<0.001
Item 5	0.636	0.798	0.806	<0.001
Item 6	0.548	0.807	0.814	<0.001
Item 7	0.411	0.819	0.828	<0.001
Item 8	0.340	0.820	0.830	<0.001
Item 9	0.420	0.821	0.826	<0.001
Item 10	0.537	0.808	0.816	<0.001
Item 11	0.489	0.812	0.820	<0.001

localities (51%), married (84.5%) and primarily completed treatment for pulmonary tuberculosis.

Table 2 depicts the response patterns of the subjects on each item of the 11 point scale. For items 1,9, 10 and 11 the agreement scores were more than 50% indicating, high perceived stigma on these domains even for patients who have completed TB treatment. Item 11 'Some people prefer not to have those with TB living in their community' had the highest pooled agreement score of 58.3%, followed by Item 10 'Some people may not want to eat or drink with relatives who have TB' at 53.3%, item 9 'Some people try not to touch others with TB' and item 1, 'Some people may not want to eat or drink with friends who have TB' at 51.33% and 51.4% respectively.

Table 3 shows that the Cronbach ɑ value for the Van Rie TB Stigma Scale is 0.826 which indicates good reliability. McDonald's ω is 0.832 which is also indicative of good reliability of the TB Stigma Scale. The Pearson correlation between individual items of the scale and the rest of the scale was above 0.3 for all items, and this correlation was statistically significant ($p < 0.001$) indicating that all items are contributing to the scale. The Cronbach ɑ value for when each item is deleted is below the pooled value of 0.826 indicating that none of the items are overtly influencing the reliability of the scale. Similarly, The McDonald's ω value for when each item is deleted is below the pooled value of 0.832. McDonald's ω is independent of the dimensionality of the scale and further strengthens the item-wise reliability of the tool (**Table 3**).

4. Discussion

India has set the target of TB elimination under the National Strategic Plan for TB Elimination by 2025. In view of this, there has been renewed interest in managing TB holistically; focusing on a multitude of factors; social, economic and environmental factors to list a few and not restricting to just the therapeutic and clinical aspects. Stigma related to tuberculosis can prevent diseased as well as cured individuals from leading a productive life.

TB Stigma has been studied prior in India.[9,10] Majority of these studies have used a qualitative or a mixed method study design, such research can easily help exploring the prevalent themes in context of Stigma. However, these methods may often require trained staff well versed with qualitative methods, and the process itself may not be suitable for rapid assessment in field.

This study is one of the first Indian study to assess the reliability of 'Community Perspectives Van Rie TB Stigma Tool', in treatment completed TB survivors, so that rapid evaluation can be done for stigma for well-established themes of discrimination.

Cronbach ɑ and McDonald's ω were used to check reliability of this tool in Indian context. The cross cultural reliability as assessed with Cronbach ɑ was 0.826 and McDonald's ω was 0.832 which indicate reliability in this population subset. A study conducted in Indonesia in 2023, reported a Cronbach ɑ for the community perspective component to be 0.807.[11] Another study conducted in Vietnam, explored the reliability of patient perspective component of the same scale, for which the Cronbach ɑ value was 0.83.[12] The original research article which introduced the scale, based out from a research conducted in Thailand in 2008, noted the Cronbach a for community perspective part of the scale to be 0.90. These studies, conducted across various countries in South-East Asia Region (SEAR) further lend credibility to findings of the current study. The varied responses of the participants, across the 11 items of the scale, indicate that there is no flooring or ceiling effect.

The study participants in this study were, treatment completed TB survivors interviewed within a month of treatment completion and even after being treated they still faced stigma. This is in line with a study conducted in Pondicherry, India in 2023, where, 56.6% of the TB patients faced stigma in public places, immediately post the treatment completion phase.[10] A multi-country study in conducted in Bangladesh, India, Malawi and Columbia had noted that themes like 'being Asked to stay away from work/groups' and 'avoided you/refused to visit' which closely relates to item 10 'Some people may not want to eat or drink with relatives who have TB' and item 11 'Some people prefer not to have those with TB living in their community' are prevalent even after treatment completion.[13] Cough with expectoration and weight loss are the usual visible hallmarks of TB, which start resolving gradually within 2 weeks of treatment initiation. A study conducted in Pakistan, Bangladesh & Nepal in 2015 noted that "disgust, untouchability and not wanting to eat together" as potential themes, which closely relate to the two other major prevalent themes in this study; item 1 'Some people may not want to eat or drink with friends who have TB' & item 9 'Some people try not to touch others with TB'.[14] This should ideally not be the case as most patients of TB treatment can't be visually distinguished from general population post treatment completion, which could be suggestive of the fact, once a person has been labelled to afflicted with TB, consequences carry ahead for significant period of time.

These themes can adversely effects individuals and families, and therefore communities with large burden of TB should be ideally screened for presence of such discriminatory thoughts and practises and through a participatory approach, and addressing the diversity through intersectionality, aim for gradual change.

The study is one of the first studies to assess the cross-cultural reliability of Community Perspective of Van Rie TB Stigma Score in India Considering the inherent diversity of the India subcontinent with respective the social and cultural backgrounds and the varied perspectives on health and TB as a disease, further studies are required for assessing region specific reliability and validity of the scale. This study focuses on treatment completed TB survivors, and thereby provides an unique perspective on stigma, which is relevant programmatically.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Analysis of the quality of life of tuberculosis patients based on the SF-36 form (case study in Banyumas Regency)

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ABSTRACT

Introduction: Indonesia is one of the countries with the largest TB burden. To date, the success of TB treatment has only been seen from microscopic examination but has not really taken into account the quality of life of TB patients. Decreased quality of life in TB patients can cause delays in treatment and have a negative impact on the continuity of treatment, causing treatment to be interrupted or incomplete (drop out). This research was conducted with the aim of knowing the quality of life of TB patients during the treatment period along with the factors that influence it.

Methods: Measuring quality of life in this study used the SF-36 instrument. This study was analytical research with a cross-sectional study design. Study subjects were all TB patients who were still undergoing TB treatment. This study was conducted in September–November 2020. Independents variables were gender, education, marital status, occupation status, income, comorbidity, smoking habits, anxiety level, emotional support, and material support. Dependent variable was quality of life of TB patients. The data analysis used was univariate and bivariate (chi square test).

Results: The majority of TB patients had a poor quality of life (51,2%). Mental health was the highest domain with a score of 88.48, while physical role was the lowest domain with a score of 40.24. The factor that significantly influenced the quality of life of TB patients was emotional support from their families (p value 0.039).

Conclusion: More TB patients had a poor quality of life with physical health was the lowest domain. Emotional support from the families of TB patients was the main factor causing the TB patient's quality of life to be low. It is important for health service providers to promote health and provide assistance to families of TB patients in an effort to increase emotional support for TB patients. Thus, TB patients can undergo treatment well and their quality of life improves during treatment.

1. Introduction

Tuberculosis (TB) is a chronic disease that continues to be a major global health issue to this day. TB ranks among the top 10 causes of death worldwide, with global TB-related deaths estimated at 1.3 million patients. Indonesia is one of the countries with the highest TB burden among the eight nations, including India (27%), China (9%), Indonesia (8%), the Philippines (6%), Pakistan (5%), Nigeria (4%), Bangladesh (4%), and South Africa (3%).[1]

The number of TB cases in Indonesia in 2018 reached 566,623 cases, showing an increase compared to the total TB cases found in 2017, which amounted to 446,732 cases. The highest number of reported cases was found in provinces with large populations, namely West Java, East Java, and Central Java. TB cases in these three provinces accounted for 44% of the total TB cases in Indonesia.[2] In Banyumas Regency, the number of TB cases has been increasing every year. The TB case data in 2017 recorded 28 new cases, and in 2018, it increased to 30 new cases.

The TB control program continues to encounter numerous challenges to this day. One of the reasons for this is that TB treatment necessitates a relatively lengthy duration, specifically 6–8 months, which affects the quality of life of TB patients, particularly during the initial phases of treatment. According to research conducted by Wahyuni, who examined the quality of life of TB patients undergoing the intensive treatment phase using the SF-36 instrument, the results revealed a low quality of life score of 63.9 for TB patients. This signifies a significant decline in their quality of life. Guo et al.'s research also indicated that TB

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significantly impacts the quality of life of patients, and Anti-Tuberculosis Drug (OAT) therapy affects both the physical and mental well-being of TB patients. The deterioration in the quality of life among tuberculosis patients can lead to treatment delays and have a negative influence on treatment adherence, ultimately resulting in treatment interruption or discontinuation (dropout).[3]

Assessing the quality of life of Tuberculosis (TB) patients is an essential aspect of efforts in the care and management of this disease. One widely used instrument for measuring quality of life is the SF-36, a questionnaire that covers various aspects of health and daily life. Previous research findings, as reported in the study by Pokam et al. (2020), have shown that the use of the SF-36 instrument has provided a clear picture of the quality of life of TB patients. In its application, SF-36 measures aspects such as physical, social, mental, and emotional dimensions of quality of life. The results of this assessment assist medical professionals and researchers in understanding the impact of TB on the daily lives of patients. This research also revealed that TB patients often face significant challenges in terms of quality of life, particularly in the physical and mental domains.[4]

Tuberculosis patients often experience a decline in their quality of life in terms of sleep disturbances, fatigue, and reduced physical activity.[5–7] Furthermore, the social aspect is also affected because the social stigma often associated with this disease can influence the patients' social relationships. However, despite these negative impacts, some studies also suggest that appropriate interventions can improve the quality of life of TB patients. For example, social support programs and psychological counseling have proven to be beneficial in enhancing the mental and emotional aspects of quality of life.[8] In the context of TB care, understanding the quality of life of patients through the use of instruments like the SF-36 is crucial in designing holistic and effective treatment. This assessment helps tailor treatment on an individual basis and ensures that TB patients receive the support that meets their needs.

2. Methods

The research was conducted in Banyumas Regency. The study was conducted from June to November 2020. This study was analytical research with a cross-sectional study design. The research population consisted of all TB patients who were still undergoing TB treatment during the study period in four primary healthcare service areas in Banyumas Regency. The sample size was calculated by using the Sample Size 2.0 software version by KC Lun and Peter Chiam National University of Singapore.[9] The sample size formula was: $= \frac{\{Z1\text{-}\alpha/2\sqrt{2P(1-P)}+Z1\text{-}\beta\sqrt{P1(1-P1)+P2(1-P2)}\}^2}{(P1-P2)^2}$. The sample size was calculated using a 95% confidence interval level; a statistical significance of 5% (alpha); a sample power of 80%; The P1 and P2 values were obtained from a study conducted by Jasmiati et al. (2017) where P1 = 0.682 (Proportion of poor quality of life of TB patients with poor family support) and P2 = 0.263 (Proportion of poor quality of life of TB patients with good family support).[10] The sampling method used was a total population approach. The sample calculation results from this formula were 22 samples per group, thus the total sample was 44 samples. This study used a total sampling method. The sample included all TB patients who were still undergoing TB treatment, a total of 41 patients. The research variables included independent variables and dependent variables. The independent variables comprised gender, education, marital status, occupation status, income, comorbidity, smoking habits, anxiety level, emotional support, and material support. Meanwhile, the dependent variable was the quality of life of TB patients during treat.

The research instruments used were questionnaires and standardized forms to measure the quality of life, specifically the Short Form-36. The questionnaire was employed to collect data on independent variables (age, gender, education, occupation, income, marital status, duration of treatment, smoking habits and anxiety levels). The stress level questionnaire and Short-Form 36 are standardized instruments, eliminating the need for validity and reliability testing. Other variables in the questionnaire (age, gender, social support, duration of treatment, smoking habits) also do not require validity and reliability testing since they are not composite variables.

Data analysis included univariate and bivariate analysis. Univariate analysis involved the frequency distribution of each research variable. Bivariate analysis utilized the chi-square test to examine the relationship between independent variables (gender, education, marital status, occupation status, income, comorbidity, smoking habits, anxiety level, emotional support, material support) and the quality of life of TB patients.

3. Results

The research results consist of respondent characteristics, a description of the quality of life of TB patients, and bivariate analysis. This research involved 41 respondents. They were TB patients who were still undergoing TB treatment. The types of anti-tuberculosis drugs prescribed were isoniazid, rifampicin, and ethambutol. The mean duration of TB treatment (n = 41) was 5.45 months (standard deviation 2.84) with a range of 1–12 months. The average respondent was 39.85 years old with an age range of 12–63 years. The following is a table describing the characteristics of these respondents.

Table 1 shows that more respondents were female (58.5%). Most of the respondents were married (68.3%) and had elementary school education (39.0%). Respondents mostly worked as laborers/farmers (26.8%) and most had income <1.5 million per month (65.9%). Majority of the respondents were new TB patients (92.7%). More respondents had comorbidities (51.2) and most did not smoke (75.6%).

Based on Table 2, the highest quality of life domain was mental health with a score of 88.48, and the lowest domain was physical role with a score of 40.24. Furthermore, for the purpose of bivariate analysis, the quality of life was categorized into two categories: good quality of life and poor quality of life based on the mean (average) values.

Table 1
Description of respondents characteristics.

No.	Variable	N	Percentage (%)
1.	Sex		
	Male	17	41.5
	Female	24	58.5
2.	Education		
	No/not yet at school	1	2.4
	Elementary school	16	39.0
	Junior high school	12	29.3
	Senior high school	10	24.4
	College	2	4.9
3.	Marital Status		
	Unmarried	13	31.7
	Married	28	68.3
4.	Occupation		
	Unemployed	9	22.0
	Housewife	10	24.4
	Laborers/farmers	11	26.8
	Trader	3	7.3
	Private	3	7.3
	Etc	5	12.2
5.	Income		
	<1,5 million Indonesian Rupiah	27	65.9
	1,5–2,5 million Indonesian Rupiah	14	34.1
6.	Comorbidities		
	Yes	21	51.2
	No	20	48.8
7.	Smoking		
	Yes	10	24.4
	No	31	75.6
8.	Treatment History		
	New TB patiens	38	92.7
	Repeat	3	7.3

Table 2
Description of quality of life domain of respondents.

Domain	Mean ± SD
Physical Functioning Score (0–100)	67.68 ± 34.55
Physical Role Score (0–100)	40.24 ± 44.67
Emotional Role Score (0–100)	42.27 ± 44.73
Vitality Score (0–100)	76.70 ± 21.92
Mentally Health Score (0–100)	88.48 ± 15.80
Socially Functioning Score (0–100)	78.65 ± 22.22
Pain Score (0–100)	70.30 ± 32.57
General Health Score (0–100)	59.26 ± 18.95
Average total score	65.45 ± 18.88

Based on Table 3, the majority of respondents had a poor quality of life (51.2%).

Table 4 shows that the variable that was significantly related to the quality of life of TB patients was emotional support from their family (p value 0.039).

4. Discussion

This research shows that in the past the majority of TB patients had a low quality of life. Previous research by Wahyuni *et al* (2018) in Medan, Indonesia also showed that the quality of life of TB patients, especially after undergoing the initial treatment stage, was in the low category.[11] The results of the study were also similar to previous research conducted by Sukartini *et al* (2020) and research in Cameroon which stated that the majority of TB patients had a low quality of life.[4,12] The domain of quality of life for TB patients with the lowest score in this study was physical role. Similar to the results of research in Iran and Cameroon which found that the physical role had the low score. This physical role describes the limited physical activity experienced by TB patients.[4,13] The low level of physical role in TB patients can be caused by TB patients experiencing malnutrition, which has implications for decreased muscle function which results in dependency and reduced ability of TB patients to carry out activities.[7]

The findings of this research reveal a significant correlation between the level of emotional support received by TB patients from their families and their quality of life. Several previous studies have also stated that family support was significantly related to the quality of life of TB patients.[10,14–16] For instance, in a study conducted by Anisah et al. (2020), it was found that TB patients who received strong emotional and physical support from their families experienced a better quality of life compared to those who felt less supported.[16] TB patients who received family support made patients more enthusiastic about undergoing treatment and motivated to recover. Family support also took the form of reminding patients to regularly take medication and taking them to a health service facility for re-control.[10]

Family support, in this context, encompasses emotional, financial, and practical aspects. Families that provide emotional support can assist TB patients in coping with the stress and depression often associated with this illness. Moreover, financial support can facilitate access to necessary medical care, including medications and doctor visits. Practical support, such as helping with everyday tasks like cooking and house cleaning, also contributes to an improved quality of life for TB patients.

Furthermore, this research highlights the importance of open communication between TB patients and their families. In a study conducted by Johnson et al. (2019), it was found that good communication between TB patients and their families can reduce the social stigma associated with the disease and enhance the social support they receive.

In this context, it is vital for TB patients and their families to collaborate in managing this illness. The support provided by families not only influences the quality of life of TB patients but can also play a role in the success of their treatment and recovery. Therefore, understanding the significance of family support in dealing with TB is a crucial first step in improving the quality of life and prognosis of patients. The role of the family is paramount in efforts to combat this disease.

Table 3
Description of quality of life of respondent based on two categories.

No.	Quality of Life	N	Percentage (%)
1.	Poor	21	51.2
2.	Good	20	48.8

Table 4
Bivariate test results of the relationship between gender, education, marital status, occupation, income, comorbidity, smoking habits, anxiety level, emotional support, material support and respondents' quality of life.

No.	Variable	Quality of Life				P Value
		Poor		Good		
		n	%	n	%	
1.	Sex					0.256
	Male	11	64.7	6	35.3	
	Female	10	41.7	14	58.3	
2.	Pendidikan					0.256
	Elementary school/No/not yet at school	11	64.7	6	35.3	
	Junior high school/Senior high school/College	10	41.7	14	58.3	
3.	Marital Status					0.437
	Unmarried	5	38.5	8	61.5	
	Married	16	57.1	12	42.9	
4.	Working Status					0.268
	Unemployed	12	63.2	7	36.8	
	Employed	9	40.9	13	59.1	
5.	Income					0.828
	<1,5 million Indonesian Rupiah	13	48.1	14	51.9	
	1,5–2,5 million Indonesian Rupiah	8	57.1	6	42.9	
6.	Comorbidity					0.642
	Yes	12	57.1	9	42.9	
	No	9	45.0	11	55.0	
7.	Smoking					0.719
	Yes	6	60.0	4	40.0	
	No	15	48.4	16	51.6	
8.	Anxiety Level					1.000
	Moderate/Severe	9	52.9	8	47.1	
	Normal	12	50.0	12	50.0	
9.	Emotional Support					**0.039**[a]
	Poor	13	72.2	5	27.8	
	Good	8	34.8	15	65.2	
10.	Material Support					0.444
	Poor	7	41.2	10	58.8	
	Good	14	58.3	10	41.7	

[a] Significant p value.

5. Conclusion

The majority of TB patients had a poor quality of life. Mental health was the highest domain with a score of 88.48, while physical role was the lowest domain with a score of 40.24. The factor that influenced the quality of life of TB patients was emotional support from their families. It is important for health service providers to promote health and provide assistance to families of TB patients in an effort to increase emotional support for TB patients. Counseling, nutritional assessment, and individual nutritional management must be repeated regularly during the treatment period to improve the physical recovery of TB patients. These measures enable TB patients to return to their activities and improve their physical role. Thus, TB patients can undergo treatment well and their quality of life improves during treatment.

Declaration of competing interest

The authors declare the following financial interests/personal

relationships which may be considered as potential competing interests:

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Financial hardship of tuberculosis patients registered under National Tuberculosis Elimination Programme (NTEP) in rural India: A longitudinal study☆,☆☆,☆☆☆,☆☆☆☆

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ABSTRACT

Background: India shares a significant proportion of the Tuberculosis (TB) burden of the world. TB diagnosis, treatment, and success are complicated by the chronic nature of the disease as well as additional stressors including financial, psychological, and social hardships, adverse events associated with management, and poor compliance towards anti-tuberculosis medications.

Methods: This is a longitudinal study conducted in the Tuberculosis Units (TUs) of rural field practice areas of the Department of Community Medicine and Family Medicine in a tertiary care hospital in Odisha. 168 diagnosed TB patients from the TUs were enrolled after registration in NTEP and were followed up every month for 6 months or treatment completion. TB patient's cost estimate tool was used to collect data regarding the cost incurred by the patients before and during the diagnosis as well as in the post-diagnosis or treatment period.

Results and conclusion: Out-of-pocket expenditure was calculated as direct, indirect, and total cost in the pre and post-diagnostic phases of the disease. The median pre and post-diagnosis direct, indirect and total costs were ₹ 12,805, ₹ 16,960 and ₹ 31,192, respectively, with almost 62 % of participants spending more than 20 % of their annual income. In this study, 41 % of participants had to stop working for more than 60 days, and 53.1 % faced distress financing due to the disease. Through this study, we found that more than half of rural TB patients still visit private health facilities, and 20 % start *anti*-TB drugs by purchasing them from private pharmacies, which incur substantial out-of-pocket expenditure. Most participants faced catastrophic costs associated with hospitalisation, lower family income, and a delay in disease diagnosis.

1. Introduction

Tuberculosis (TB) is a significant cause of mortality and morbidity in the poor. TB is among the top 10 causes of death in low and middle-income countries.[1] It was the leading cause of death from a single infectious agent (ranking above HIV/AIDS) before the COVID-19 pandemic stepped in. Globally, in 2021, about 10.6 million people were diagnosed with TB, an increase of 4.5 % from 2020, to 1.6 million died due to the disease.[2]

According to available data, people in low and middle-income countries typically spend between $55 to $8198 on TB diagnosis and treatment.[3] India's present health financing situation and unorganised health care delivery with private player predominance predispose the patients to incur out-of-pocket expenditure (OOPE) to cover medical costs.[4] OOPE refers to the direct payment made by individuals at the time of service usage for medical and non-medical expenses (such as

☆ India shares a significant proportion of the Tuberculosis (TB) burden of the world. TB diagnosis, treatment, and success are complicated by the chronic nature of the disease as well as additional stressors including financial, psychological, and social hardships, adverse events associated with management, and poor compliance towards anti-tuberculosis medications. Understanding the economic burden is vital to patient-centered care, strengthening health system, and achieving of Sustainable Development Goals (SDG) targets of 2030. The existing literature indicates that TB patients often incur substantial out-of-pocket expenses for their diagnosis and treatment. The finding of the study shed light on the financial burden faced by rural TB patients in India.☆☆ We also agree to provide post-publication update on the article.☆☆☆ We have done sufficient work in the field to justify authorship for this article.☆☆☆☆ We hereby transfer, assign, or otherwise convey all copyright ownership, including any and all rights incidental thereto, exclusively to the journal, in the event that such work is published by the journal.

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travel, lodging, and food costs), but not for prepayment of medical expenses in the form of taxes or particular insurance premiums.[5] Previous studies in India have shown that the proportion of Tuberculosis patients facing catastrophic expenditure to be between 7 and 86 %.[6–10] These findings present a wide gap and are alarming, considering the programme's pro-poor prioritises providing free laboratory services, treatment, and follow-up to patients attending public health facilities and those referred from private. Previous studies have also found that people resort to several financial coping mechanisms to meet the high cost of care superadded with reduced income during the disease and treatment period. The most commonly adopted mechanisms are borrowing money, taking loans, mortgaging valuables, spouse or other member having to work, etc..[7,9–11] Catastrophic costs are defined as expenses that are excessive relative to the household's ability to pay, thereby driving families into financial hardship. A condition where the household meets their expenditure by borrowing and/or selling any physical assets is also known as 'hardship or distress financing'. Studies have also found that distress financing is relatively common among tuberculosis patients and more so in hospitalized patients.[4]

Understanding the economic burden is vital to patient-centered care, strengthening health system, and achieving of Sustainable Development Goals (SDG) targets of 2030. The existing literature indicates that TB patients often incur substantial out-of-pocket expenses for their diagnosis and treatment. However, there is a lack of comprehensive longitudinal studies that assess the economic burden faced by TB patients in rural areas of India. The finding of the study shed light on the financial burden faced by rural TB patients in India. The objective of this research is to assess out-of-pocket expenditure among patients undergoing antitubercular treatment in NTEP of Khordha District in Odisha.

2. Material and methods

2.1. Study design and setting

This is a longitudinal study conducted in 2 blocks of Khordha district (total population 2,251,673) of Odisha state with 51.84 % living in rural regions of the district. The district is divided into ten TB units corresponding to the respective blocks, which cater to the diagnostic and treatment needs of the population in the district. Thus for our study, we selected two TB units randomly to recruit the required sample size.

The total study duration was 18 months (April 2021–September 2022). Participants were recruited during the initial 12 months and followed up for six months or till treatment completion.

2.2. Inclusion and exclusion criteria

All newly diagnosed patients of Tuberculosis from the selected TB units in the Khordha district, willing to participate after informed written consent were included in the study. However, drug resistant cases, or cases complicated with other comorbidities and in need of hospitalisation due to comorbidities such as cancer, etc., terminal and moribund cases were excluded from the study.

2.3. Sample size

The prevalence of catastrophic expenditure among TB patients was 32.4 % among 102 tuberculosis patients in a study conducted in Puducherry district in 2018 by Prasanna et al.[7] Assuming this proportion and with absolute precision of 8 %, the sample size (N) for the present study was calculated to be 137 ($p = 51.2$, $q = 48.8$, $d = 8$ %; $N = (4 \times 45.5 \times 54.5) \div (8 \times 8)$). Adding a 20 % attrition rate, the final sample size (N) was fixed at 164.

2.4. Sampling strategy and recruitment

Two TB units were randomly selected to recruit 168 patients using universal sampling. Patients were recruited from Mendhasala TU for the first six months, followed by Tangi TU in the next six months. The participants were identified from the line list of cases obtained from Senior Treatment Supervisor from the manually maintained register or Nikshay portal for the corresponding Tuberculosis Units. Patients/DOTS (Directly Observed Therapy Short course) supporters were contacted over the phone to confirm their residence and prior consent was taken to visit their residence. Patients who were not present or could not be contacted by any means were not included in the study.

2.5. Outcome measures

The financial burden was assessed in terms of out-of-pocket expenditure and calculated at two different time points.

a) pre-diagnostic and diagnostic costs after the onset of symptoms till confirmation of diagnosis
b) cost incurred during the intensive and continuation phase of the treatment

And the total cost was calculated by adding.

a) Direct medical expenses
b) Direct non-medical expenses
c) Indirect expenses
d) Total expenses

2.6. Operational definitions

Out-Of-Pocket Expenditure (OOPE): As per the World Health Organization National Health Account database, out-of-pocket expenditure is any direct outlay by households, including gratuities and in-kind payments, to health practitioners and suppliers of pharmaceuticals, therapeutic appliances, and other goods and services whose primary intent is to contribute to the restoration or enhancement of the health status of individuals or population groups. We have highlighted the following sub-categories of out-of-pocket expenditure, which are used for assessment in this study.

- "Direct medical costs were categorised as costs incurred for hospital day charges, consultation charges, and costs for radiography, laboratory, other procedures, drugs, and prescribed nutrition.
- Direct non-medical costs included: costs for travel, food, and accommodation (including that of an accompanying member) to attend health facility, and the travel costs for DOT visits.
- Indirect costs included the patient's and accompanying member's loss of wages, and a measure to assess economic impact calculated as monthly family income before TB minus monthly family income at the time of the interview.

The total costs incurred was the sum of direct medical, direct non-medical and indirect costs, and were said to be catastrophic if they exceeded 20 % of their annual household income (excluding the DBT (Direct Benefit Transfer) amount)".

2.7. Data collection and statistical procedures

For this study, we used a self-designed semi-structured questionnaire to collect the basic demographic and clinical information about the study participants. For estimation of the cost incurred during the pre and post-diagnosis of tuberculosis, 'Patient's cost estimate tool by KNCV Tuberculosis Foundation, WHO and Japan Anti-tuberculosis Association' was used.

Descriptive analysis was done and presented as proportions and 95% CI for categorical variables and mean with standard deviation for continuous variables. The association between dependent and

independent variables were analysed with chi-square test, t-tests, bivariate logistic regression and multivariable logistic regression, wherever required.

All the collected data were entered in Epicollect5 and analysed using Microsoft Excel and IBM SPSS version 26.

3. Results

3.1. Enrolment and sociodemographic characteristics of study participants

During the study a total of 206 patient data were obtained from the two TUs and a total of 168 patients were finally included in the study after the exclusion. Among them, 160 (95.2 %) were completely followed up till the end of 6 months and included in the analysis. The recruitment and exclusion of participants is presented in the flow diagram Fig. 1.

The mean ± (SD) age of participants in the study was 42.5 ± 17.2 years. The majority (112 (70 %)) of the individuals belonged to the productive age group 18–60 years and 62.5 % were males.

The coverage of any form of health insurance among the participants was 55.0 % of which most of them were covered under BSKY (Biju Swasthya Kalyan Yojana) and a few others by CGHS or other private insurance. The median annual income of patients was ₹ 72,000 (₹ 0 - ₹ 1,20,000), and that of the household was ₹ 1,44,000 (₹ 96,000 - ₹ 2,61,000). The index patient was the prime income earner in 23 (22.6 %) households. The median number of earning members in a household was 1.[1,2] Prevalence of tobacco and alcohol usage in the past 12 months was 57.5 % and 17.8 % respectively. The sociodemographic profile of the participants is presented in Table 1.

Of all the enrolled participants, 118 (73.8 %) were smear-positive pulmonary TB cases, and 13 (8.1 %) were smear-negative pulmonary TB cases. Extra-pulmonary cases constituted 18.1 % and mainly included TB lymph node and 1 case each of TB bone, TB eye, and TB abdomen. Associated comorbidity was seen in 46 (28.75 %) of participants, of which 35 (21.9 %) were diagnosed cases of diabetes mellitus, 7 (4.4 %) were diagnosed cases of hypertension, and 16 (8.1 %) had other comorbidities like COPD, asthma, CAD, Stroke, etc. The complete morbidity profile has been summarised in Table 2.

A majority (92 (57.5 %)) of participants reported having visited a private clinic or facility as their first healthcare facility. However, only 61 (38.1 %) of patients were diagnosed with tuberculosis at private facilities while the rest were diagnosed with tuberculosis at government facilities. However, 31 of 42 smear-negative and EPTB cases were diagnosed at private facilities. The median distance of 1st healthcare facility to the residence was 8 km (4.25–22.5 km) (mean – 12.9 km) for a government facility and 8 km (2.5–14 km) (mean – 9.4 km) for a private facility. More than 60 % of participants visited at least 2 healthcare facilities before diagnosis. The median number of healthcare facilities (government/private) consulted was 2,[1–3] and the median number of visits to healthcare facilities was estimated to be 5[3–7] per patient before diagnosis. Healthcare visits were particularly high in extra-pulmonary tuberculosis patients, i.e. 8 (4.5–11). About 18 % (29) of participants required hospitalisation before the diagnosis of the disease. Reasons cited for visiting private healthcare facilities in the pre-diagnosis phase have been summarised in Table 3.

The drugs were usually procured from DOTS facility by DOTS supporters or the patient in 152 (95 %) of the subjects, and 8 (5 %) of them purchased the medication from pharmacies. Thirty-three (20.6 %) participants initially started anti-tubercular treatment by purchasing the drugs, and 41 (25.6 %) had to buy TB medications at least once during the course of treatment. Of the 41 participants, 39 % participants

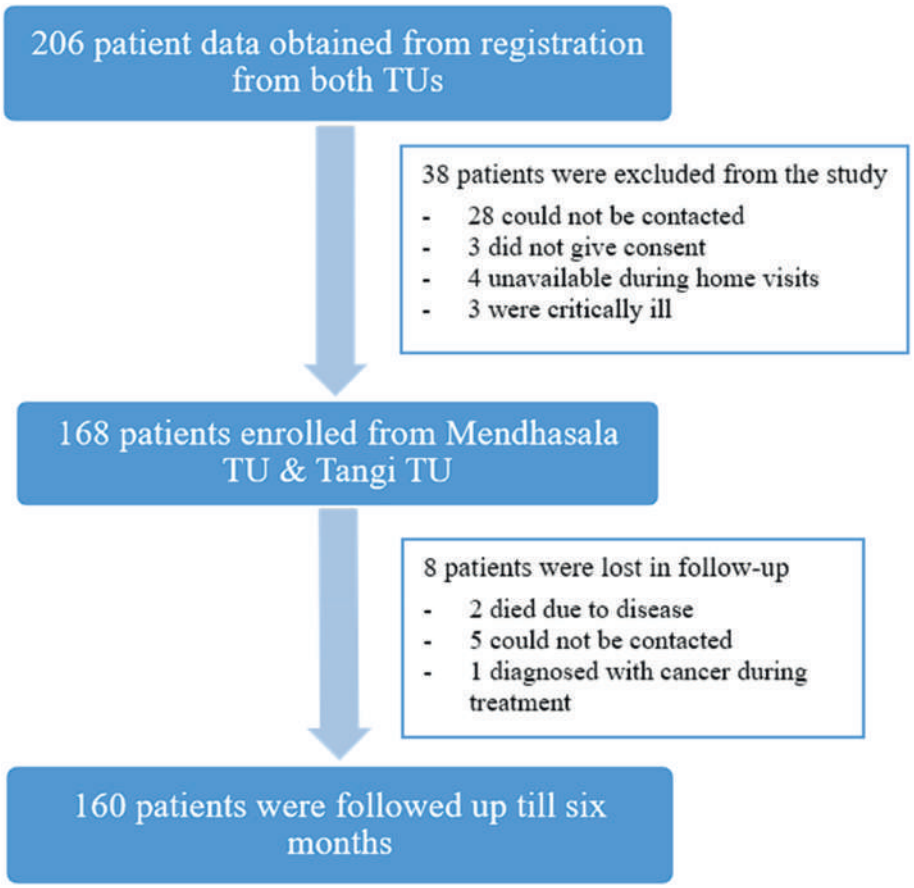

Fig. 1. Recruitment of study participants.

Table 1
Socio-demographic details of the study participants (TB patients).

Demographic variables	Study population (%) N = 160
1. Age distribution:	
Age group (Years)	
a) < 18	7 (4.4)
b) 18-29	31(19.4)
c) 30-39	35(21.9)
d) 40-49	24(15.0)
e) 50-59	30(18.8)
f) 60-69	23(14.4)
g) > 70	10(6.3)
2. Sex (%)	
a) Male	100(62.5)
b) Female	60(37.5)
3. Religion (%)	
a) Hindu	157 (98.1)
b) Muslim	3 (1.9)
3. Educational qualification (%)	
a) Illiterate	26(16.2)
b) Primary	86(53.8)
c) Middle	31(19.4)
d) High School	10(6.6)
e) Graduate & Above	7(4.4)
4. Occupation (%)	
a) Labourer	40(25.0)
b) Homemaker/Housewife	33(20.6)
c) Unemployed	25(15.6)
d) Service	19(11.9)
e) Independent profession[a]	15(9.4)
f) Business	13(8.1)
g) Cultivation	12(7.5)
h) Caste occupation[b]	3(1.9)
5. Marital Status (%)	
a) Married	122(76.2)
b) Unmarried	29(18.1)
c) Widow/Widower	7(4.4)
d) Divorce	2(1.3)

[a] Independent profession includes jobs like cook, welding mechanic, private contractor, tailor, carpenter, etc.
[b] Caste occupation includes jobs like priest, artisan, etc.

Table 2
Morbidity profile of study participants.

1. Most common reported symptoms prior to diagnosis (%)[a]	N = 160
a) Cough	125 (78.1)
b) Loss of appetite/weight loss	101 (63.1)
c) Fever	82 (51.2)
d) Blood in sputum	40 (24.5)
e) Night sweats	19 (11.9)
f) Others[b]	44 (27.5)
2. HIV Status (Negative) (%)	160 (100)
3. Type of TB	
a) Pulmonary Smear + ve TB	118 (73.8)
b) Extra-pulmonary TB	29 (18.1)
c) Pulmonary Smear -ve TB	13 (8.1)
4. Previous TB treatment/Treatment Regimen (%)	
a) New Case	131 (81.9)
b) Retreatment	18 (11.3)
c) Treatment after loss to follow up	11 (6.9)
5. Comorbidity: (%)	
a) Diabetes Mellitus	35 (21.9)
b) Hypertension	7 (4.4)
c) Others (COPD, Asthma, CAD, Stroke etc.)	13 (8.1)

(COPD- Chronic Obstructive Pulmonary Diseases, CAD – Coronary Artery Disease).
[a] Multiple responses recorded from participants.
[b] Other symptoms predominantly include neck swelling, fatigue, breathlessness, chest pain, weakness, back pain etc.

Table 3
Healthcare facility attended before, during and after diagnosis and reasons cited by study participants (n = 160).

Variables	N (%)
1. First Health Facility encounter (%)	
a) Government health facility	68 (42.5)
b) Private health facility or clinic	92 (57.5)
2. Place of diagnosis (%)	
a) Government facility	99 (61.9)
b) Private facility	61 (38.1)
3. Reason for visiting private facility pre-diagnosis(%) (n = 92)	
a) Better/Quicker care at private facility	24 (26.1)
b) Recommendations from friends and peers	14 (15.2)
c) Didn't know about TB related service	9 (9.8)
d) Purchased medicines work better	8 (8.7)
e) Any other reason	6 (6.5)
f) Delayed care at Govt facility/urgency of the situation	6 (6.5)
g) Stigma/Not disclosing to ASHA	4 (4.3)
h) Government facility is far/inconvenient to access	3 (3.3)
i) No specific reason/Usual point of care	18 (19.6)
4. Number of patients following up at private clinics and hospitals post diagnosis: (%)	61 (38.1)
5. Reason for visiting private clinics and hospitals post diagnosis: (n = 61) (%)	
a) Diagnosed and started ATT from the private facility	17 (27.8)
b) Government facility is far/inconvenient to access	13 (19.1)
c) Better/Quicker care at private facility	13 (19.1)
d) Purchased medicines work better	8 (11.8)
e) Didn't know about TB related service	6 (8.8)
f) Word of mouth/recommendation	5 (7.3)
g) Stigma/Not disclose to ASHA	5 (7.3)
h) Any other reason	4 (5.9)
6. Reason for buying TB medicine: (n = 41)	
a) Unaware of free treatment facility	16
b) Not referred to DOTS center/Advised by physician	(39.02)
c) Purchased medicines work better	8 (19.5)
d) Admitted and started medication at a private hospital	6 (14.6)
e) Adverse effect from free medications	4 (9.8)
f) Others	3 (7.3)
	3 (7.3)
7. Median number of days for which ATT was bought: (IQR) (n = 41)	20 (15–40)
8. Method of drug procurement (%) – how they usually sourced the drugs when required	
a) Self-procured from government facility	47 (29.4)
b) DOTs supporter procured (ASHA/ANM/others)	33 (20.6)
c) Both a and b	72 (45.0)
d) Purchased by self	8 (5.0)

(ATT-anti-tuberculosis treatment; ASHA – Acreditted Social Health Activist; ANM – Auxillary Nurse and Midwife; TB - Tuberculosis).

reported unawareness of free drugs available under the programme. Other reasons for purchasing antituberculosis medicines have been summarised in the Table no 3.

3.2. Out-of-pocket expenditure before diagnosis and during treatment of tuberculosis

The cost of tuberculosis care and treatment has been calculated and presented as the median cost (interquartile range) to provide a perspective of the financial hardship incurred by the study participants. As per calculated estimates, median pre-diagnostic total cost was lesser than post-diagnosis costs viz. ₹12,048 (₹5157.50 - ₹32,964.20) and ₹19,910.50 (₹9325 - ₹ 36,715) respectively. The median pre-diagnosis direct cost was ₹ 4575 (₹462 - ₹9787.75), of which a major part was associated with travel costs in all the patients, while cost incurred from investigations and drugs was a major contributor to the patients visiting private facilities.

The median direct cost of patients who visited private facilities for diagnosis or follow-up was ₹16,310 (₹10,470 – ₹27,896), approximately four times when compared to those who never visited any private facility ₹4290 (₹2455.5 – ₹8677.5). Twenty-one were hospitalized during and before diagnosis and the direct cost incurred from hospitalisation

was significantly higher with a median direct cost of ₹12,000 (₹4500 - ₹55,000) and indirect cost of ₹4200 (₹1500 - ₹6000). Work absenteeism due to disease was seen in 72 (70.6 % of previously employed individuals), with a median number of 36.5 days (20.25–60) lost to illness.

The median post-diagnosis cost of care was higher than the pre-diagnosis cost and was largely contributed by indirect costs with a median of ₹12,212.50 (₹1777.50 - ₹29,325). It was also found that 61 (38.13 %) participants visited several private health facilities during the post-diagnosis phase which contributed significantly to the estimated median direct cost of ₹3580 (₹800 - ₹7287). A detailed summary of all costs has been listed in Table 4.

Owing to the high cost of tuberculosis care, 85 (53.1 %) of the participants had to resort to distress financing. People facing catastrophic expenditure were at a 4 times higher risk of experiencing distress financing (OR – 4.02, Chi-square- 7.52, $p < 0.01$). 82 out of them borrowed money from several sources as shown in Fig. 2. 124 (77.5 %) of the participants reported spending an extra amount of money on nutritious food and supplements with a median spending of ₹1965 (₹400-₹3753.75) in the six months.

The proportion of CHE (catastrophic health expenditure) according to accepted theories of total cost exceeding 20 % and 10 % of annual household income is 61.9 % and 78.1 %, respectively. In this study, we have chosen a 20 % cut-off for further analysis of catastrophic expenditure in households.

3.3. Factors determining the catastrophic health expenditure (CHE) of households

The categorical variables were analysed with chi-square or Fisher exact test to see the association of sociodemographic, comorbidity, health care facility, and drug compliance with catastrophic health expenditure among households with tuberculosis.

Bivariate and Multivariable logistic regression was carried out to see the effect of independent variables on catastrophic health expenditure among participants. Multivariable logistic regression was done by adjusting for all the associated factors (with p-value <0.25). The details of the bivariate and multivariable regression analysis have been summarised in Table 5. Analysis revealed that lesser educational qualification, employment status, lower annual household income (<₹1,44,000), tobacco use, delay in diagnosis (>7 days), and hospitalisation with the disease have a statistically significant association with CHE ($p < 0.05$).

Table 4
Out-of-pocket expenditure details of the participants before and during diagnosis and during treatment (n = 160).

1. Pre-diagnosis and Diagnosis Costs: (Rupees (₹))	Median (IQR)
a) Direct Medical costs (medical visits and fees, tests, drugs)	4575 (462.5–9787.75)
b) Direct non-Medical costs (travel, food, accommodation in medical visits)	1250 (547.5–2675)
c) Indirect costs (cost of accompanying person, loss of wages, etc.)	2966.7 (654.2–12152.8)
d) Total costs (Direct and Indirect)	12,048 (5157.5–32964.2)
2. Post-diagnosis Costs: (Rupees (₹))	(Median (IQR))
a) Direct Medical costs (medical visits and fees, tests, drugs)	3580 (800–7287)
b) Direct non-Medical costs (travel, food, accommodation in medical visits)	1150 (227.5–2500)
c) Indirect costs (cost of accompanying person, loss of wages, etc.)	12212.5 (1777.5–29325)
d) Total costs (Direct and Indirect)	19910.5 (9325–36715)
3. Pre and Post-Diagnosis Costs: (Rupees (₹))	(Median (IQR))
a) Direct costs (medical visits and fees, tests, drugs, travel, accommodation, food etc.)	12,805 (5315–21705)
b) Indirect costs (cost of accompanying person, loss of wages, etc.)	16,960 (3844.6–48575)
c) Total costs (Direct and Indirect)	31,192 (18180.8–74090)
4. Median number of working days lost to illness: (IQR)	36.5 (0–117.75)
5. Reason for not going to work:[a] (n = 72) (%)	
a) Feeling tired/job too strenuous/unable to work	47 (65.3)
b) Not feeling in good health most of the days	41 (56.9)
c) Self-decision/no apparent reason	12 (16.7)
d) Stigma/fear of disclosing	8 (11.1)
e) Employer asked to take leave	6 (8.3)
f) Drug adverse effect	4 (5.6)
g) Asked not to go by caregiver or equivalent	3 (4.2)
h) Other reasons[b]	12 (16.7)

[a] Sources have been recorded with multiple responses per participant.
[b] Other reasons for not going to work includes working outside the town, restriction of movement/mobility, fear of missing medication, afraid to go out, to avoid alcohol habits, etc.

4. Discussion

In this longitudinal study, we assessed the sociodemographic profile, and out-of-pocket expenditure associated with tuberculosis and its care during the pre-diagnosis and the post-diagnosis period. Also, we followed up with the patients during the entire period of anti-tubercular therapy to record the additional medical, non-medical and indirect financial burden. This is among the first studies to estimate the out-of-pocket expenditure borne by TB patients in programmatic settings in rural areas of Odisha.

It is established that males are more prone to tuberculosis infection[12] and in this study, it was found that more males were currently under TB treatment than females, which is also consistent with the finding from the TB prevalence survey report 2021.[13] About 45.7 % of participants were below the age of 40, and 70 % belonged to the working age group of 18–59 years. A study by Shewade et al. done in several districts of India reported that 54 % of participants were below 45 years of age.[14] As per WHO Global Tuberculosis Report, adult men and women carry the heaviest burden of the disease, accounting for 56.5 % and 32 % of all TB cases in 2021.[2]

The majority of study participants were educated to middle school with approximately 16 % lacking any formal education. Corresponding with their educational qualification, 25 % of the participants were engaged as daily wage labour, while 15.6 % were without employment. Similarly, the median annual income of the individual and household was ₹72,000 and ₹1, 44,000 respectively, which was lower than the state average reported in the Economic Survey 2020–21. This may be attributed to the rural setting and higher prevalence of unemployed or daily wage labours. Study participants using tobacco-related products in the past 12 months were found to be 57.5 %, which is more when compared to the Global Adult Tobacco Survey (GATS) 2 report for Odisha in which 45.6 % of the population were found using any form of tobacco.[15] We also found a higher prevalence of diabetes mellitus among the study participants, i.e. 21.9 % as compared to National Non-communicable Diseases Monitoring Survey (NNMS) which reported 9.1 %. However, higher prevalence of diabetes is expected among tuberculosis patients and has been established through other studies in India and outside.[16,17]

In this study, 57.5 % of participants reported first to any private healthcare facility to seek care for their health condition, however in contrast 62 % of them received the diagnosis from a government facility. Other studies have also reported this kind of health seeking behaviour, like Veesa et al. done in rural areas of Tamil Nadu, in which 65 % of individuals with tuberculosis visited a private healthcare facility first.[11] This preference of private healthcare facilities can be attributed to lack of awareness regarding availability of CBNAAT (Catridge based Nucleic Acid Amplification test) facilities at government hospitals rather than in private clinics or labs. The higher proportion of individuals diagnosed through government facility could be attributed to the sampling frame of the study, as subjects recruited were enrolled under NTEP so are more likely to have a diagnosis from a government facility. Most of them visited private clinics for better and faster care, or were referred through recommendations by friends and peers. However, it was also seen that 38 % of the participants preferred following up with private

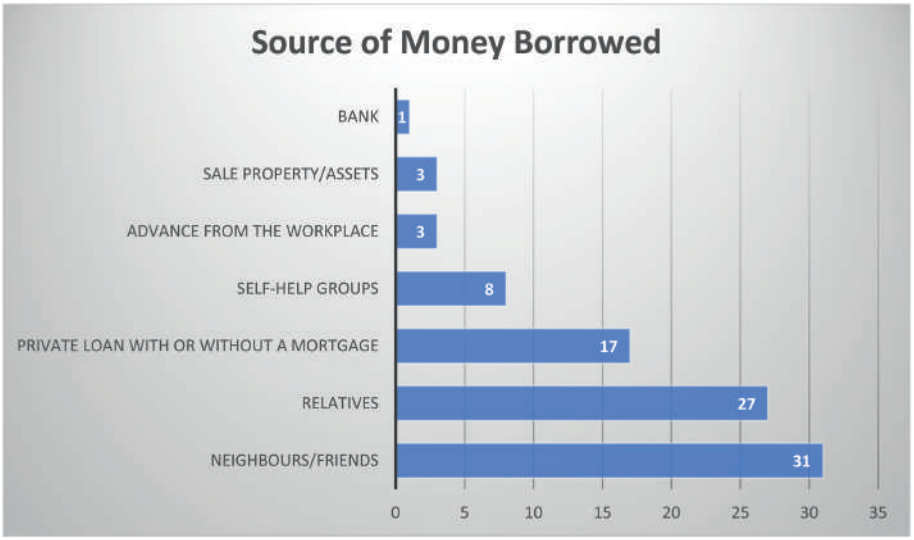

Fig. 2. Various sources from which the participants borrowed money. (Multiple responses per participant) (N = 82).

practitioners despite having been diagnosed at a government facility.

The median direct, indirect, and total cost of care associated with tuberculosis was ₹ 12,805, ₹16,960, and ₹31,192, respectively. Several studies have reported the total direct cost ranging from ₹ 1105 - ₹4600..[7–9,18,19] The considerably higher total direct cost can be attributed to hospitalisations, health seeking at private facilities and dependence on private transport facilities in remote areas. About 70 % of study participants visited private health facilities at least once during the disease. The study participants who were diagnosed at a private facility usually spent more than that in government facilities and preferred following up at the same facility later on during the treatment causing excessive direct costs. We found that the median direct cost of patients who visited a private facility for diagnosis or follow-up was ₹16,310, approximately four times when compared to those who never visited any private facility (₹4290). This discrepancy may also be accounted to the statistical reporting of cost as mean cost in all other studies, whereas we have presented the data in median considering the skewed distribution of cost among participants. According to the Indian National TB prevalence survey 2019–21, the total median cost (direct) for TB diagnosis and treatment in government hospitals was Rs.5000 (range Rs.1000 to Rs.28,000), and in private hospitals was Rs.13,250 (range Rs.1000 to Rs.28,000).[13]

In this study, the indirect cost was higher than the direct cost associated tuberculosis diagnosis and treatment. This pattern of higher indirect cost of care has been reported in several other studies like, Sarin et al. Muniyandi et al., Poornima et al. etc.[8,9,19] The median indirect cost was mostly related to the loss of wages suffered by the participants and partly due to the caregiver. In this study, 25 % of participants were daily wage earners and lost a median of 36 working days due to the disease, and 41 % of participants stopped working for more than 60 days, which explains the high indirect cost found in the study. It is imperative that such data may have been over-reported by study participants. However, in a previous study by Muniyandi et al. conducted in 4 TUs of Chennai reported the mean indirect cost of care to be ₹ 15,696 (S.D – 33,778).[8]

We found that 61.9 % of the participants spent more than 20 % of their total household income during the course of disease diagnosis and treatment. There have been multiple studies done at varied settings and results show a significant variability depending on study setting and time. In a prospective research conducted in 2011–2012, which collected income and expense data from TB subjects being treated by the NTEP in Bengaluru, 86 % of respondents reported costs that exceeded 20 % of their yearly income.[20] While, a study in Delhi by Sarin et al. (2018), reported that the incidence of catastrophic costs was lower (7 %) due to robust and decentralised NTEP services and the low hospitalisation rate (4 %).[19] Several Indian studies have reported the prevalence of CHE to be 7–86 %.[4,7,10,18–20] This wide variability in proportion of households facing catastrophic expenditure can be attributed to socioeconomic disparities, social protection mechanisms, awareness and access to healthcare services, policy and health system differences.[7,8,21,22]

We found several sociodemographic and treatment related factors to be associated with the catastrophic expenditure in households. Lower educational qualification, employment status, tobacco usage, low annual household income, hospitalisation, and delay in diagnosis were some of the significant determinants of household catastrophic expenditure. Educational qualification can significantly affect the cost of care directly as well as indirectly. Better education ensures better socioeconomic conditions and lesser stress of bearing treatment expenses; similar findings were seen in a study by Veesa et al..[11] A study by Muniyandi et al. has also found that unemployment (aOR, 0.2; 95 % CI, 0.1–0.5; $P < 0.001$) and higher annual household income (Rs 1–200 000, aOR, 0.4; 95 % CI, 0.2–0.7; $P = 0.004$; Rs > 200,000, aOR, 0.2; 95 % CI, 0.1–0.5; $P < 0.001$) were associated with a decreased risk of having catastrophic expenditure while tobacco use was associated with higher catastrophic cost.[8] A study by Yadav et al. analysed that with a rise in income, the expenditure towards disease increases, but the proportion of cost to annual income reduces. The proportion of CHE found is influenced by the sociodemographic characteristics of the study population.[25] In order to alleviate the financial strain on households caused by tuberculosis (TB), strategies such as offering assistance for transportation, providing medications for alleviating symptoms, supplying specialized nutrition, compensating for income loss and ensuring equitable access to TB services in rural and hard-to-reach areas through private provider partnerships and patient provider support agencies (PPSA) could be feasibly enacted.[3,23,24] Multicentred studies to examine the socioeconomic, cultural, health system and geographical factors, with the aim to elucidate the contributing factors for catastrophic health expenditure can be developed in future to understand and inform targeted intervention.

4.1. Strengths and limitations

We used a validated tool for the assessment of financial associated with the disease and treatment. The direct, indirect and total costs have been calculated for the total period of patient's diagnosis and treatment. In person visit to all patients and objective verification of bills and documents wherever possible was done by the investigator.

Table 5
Bivariate and Multivariable logistic regression analysis of catastrophic expenditure with associated parameters. (n = 160).

Parameter	Catastrophic expenditure N(%)	Odd's ratio (95 % CI)	P value	Adjusted Odd's (95 % CI)	P value
1. Sex					
a. Male	71 (70.3)	ref	ref		
b. Female	28 (47.5)	0.39 (0.19–0.78)	<0.01		
2. Educational qualification					
a. Illiterate, Primary school	21 (80.8)	3.86 (1.25–11.94)	0.02	4.63 (1.13–18.85)	0.03
b. Middle school	53 (61.6)	1.48 (0.72–3.02)	0.28	1.52 (0.57–4.00)	0.57
c. High school, Graduate & Above	25 (52.1)	ref	ref	ref	ref
3. Employment status					
a. Unemployed	22 (37.9)	ref	ref	ref	ref
b. Employed	77 (75.5)	5.04 (2.51–10.11)	<0.01	8.74(3.16–24.16)	<0.01
4. Number of earning member					
a. 1	65 (66.3)	0.62 (0.32–1.18)	0.15		
b. >1	34 (54.8)	ref	ref		
5. Annual household income					
a. < 1,44,000	68 (77.3)	4.49 (2.27–8.9)	<0.01	6.34 (2.60–15.46)	<0.01
b. >1,44,000	31 (43.1)	ref	ref	ref	ref
6. Health insurance coverage					
a. Yes	41 (56.9)	1.46 (0.76–2.77)	0.24		
b. No	58 (65.9)	ref	ref		
7. Type of Tuberculosis					
a. Pulmonary smear + ve	77 (65.3)	ref	ref		
b. Pulmonary smear -ve	9 (69.2)	1.19 (0.34–4.12)	0.77		
c. Extra-pulmonary	13 (44.8)	0.43 (0.19–0.98)	0.05		
8. Any Comorbidity					
a. Yes	35 (76.1)	2.48 (1.15–5.38)	0.01		
b. No	64 (56.1)	ref	ref		
9. Tobacco usage					
a. Yes	67 (72.8)	3.10 (1.55–5.83)	<0.01	2.53 (1.01–6.34)	0.04
b. No	32 (47.1)	ref	ref	ref	ref
10. Alcohol use					
a. Yes	22 (75.9)	2.20 (0.87–5.52)	0.09		
b. No	77 (58.8)	ref	ref		
11. Follow up facility					
a. Only government	54 (54.5)	ref	ref		
b. Both government and private	45 (73.8)	2.34 (1.17–4.69)	0.01		
12. Ever Hospitalized					
a. Yes	27 (87.1)	5.34 (1.77–16.15)	<0.01	21.07 (3.86–104.27)	<0.01
b. No	72 (55.8)	ref	ref	ref	ref
13. Place of starting treatment					
a. Government	73 (57.5)	ref	ref		
b. Private	26 (78.8)	2.74 (1.11–6.79)	0.02		
14. Bought TB Medicine					
a. Yes	30 (73.2)	1.98 (0.90–4.31)	0.08		
b. No	69 (58.0)	–	–		
15. Delay in diagnosis					
a. <7 days	3 (33.3)	ref	ref	ref	ref
b. > 7 days	96 (63.6)	3.49 (0.84–14.51)	0.08	5.43(1.06–27.70)	0.04
16. Visited health facility due to ADRs					
a. Yes	43 (68.3)	1.57 (0.81–3.06)	0.18		
b. No	56 (57.7)	ref	ref		

-The Odd's have been adjusted to all associated variables like sex, education, income group, employment status, health insurance coverage, number of earning members, type of tuberculosis, comorbidity status, alcohol and tobacco usage, place of starting treatment, purchasing TB medicines, delay in diagnosis, hospitalisation, follow up health facility seeking healthcare with ADRs, and adherence and applying backward stepwise logistic regression; retaining all variables with a p-value of <0.05 in the model and rejecting with p-value >0.1.
The model summary Nagelkerke R^2 value = 0.522.
(ADR – adverse drug reaction; TB -tuberculosis).
*Other occupation involves independent profession, business, caste occupation and cultivation.

Only notified cases were included in the study, privately diagnosed and treated cases might have been missed.

The data collected from patients with TB were self-reported, which may be subject to recall bias. Underreporting of income and over-reporting of costs are inherent to such studies.

Indirect costs for patients who were not working, such as students, those who work at home, and those who were unemployed, may have been underestimated, which might have resulted in unemployed patients being less likely to have experienced catastrophic costs.

All the patients who purchased medicines from private pharmacies due to stigma or unawareness, were counselled and everyone was linked to DOTS facility. This may bias the findings of out-of-pocket expenditure.

Cost incurred by the household as a result of treatment failure, relapse, death and disability of the patient has not been included due to the study protocol and timeline.

5. Conclusion

The study brings out the unusually higher cost of care associated with tuberculosis diagnosis and care in patients despite being enrolled into NTEP. These costs are generally associated with hospitalisation, delay in diagnosis, travel and higher dependence on private health care providers during the pre-diagnosis phase of the disease. Notably, a

fourth of participants had to purchase TB medications at least once during the treatment and stresses on the need for awareness, accessibility and availability of free medications under the NTEP. Additionally, loss of working days and lower household income of the families predisposes them to catastrophic expenditure and distress financing. This research study provides valuable insights into the financial burden of tuberculosis in India, specifically focusing on estimating the out-of-pocket expenditure and catastrophic costs borne by TB patients. The findings reveal the significant economic challenges faced by individuals and households affected by TB, emphasizing the urgent need for interventions and policy reforms to alleviate this burden and improve health outcomes.

5.1. Ethical consideration

The Ethical clearance was obtained from the Institutional Ethics Committee. Data collection was started after the IEC approval. Participants were given a participant information sheet and explained about the study and data confidentiality. The participants were informed that they could withdraw from the study at any point in time. Informed written consent was taken from all the participants. Assents were also collected for participants below 18 years of age.

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Presentation at a meeting

None.

Author's contributions

AP, BKP, AM contributed in development of concept, literature search and design of the study. AP participated in data acquisition, data analysis and prepared the manuscript. BKB, AM participated in manuscript editing and review.

Financial competing interests

I declare that I have no financial interests or relationships that may have influenced the work presented in the submitted manuscript. There are no financial relationships with any organizations or entities that could inappropriately influence the content of this work.

Non-financial competing interests

I declare that there are no non-financial competing interests, including but not limited to personal, professional, political, academic, or intellectual interests that might be perceived as influencing the conduct or reporting of this research.

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Declaration of Generative AI and AI-assisted technologies in the writing process

During the preparation of this work the author(s) used ChatGPT ver 3.5 in order to rephrase/shorten some parts of the manuscript. After using this tool/service, the author(s) reviewed and edited the content as needed and take(s) full responsibility for the content of the publication.

Declaration of competing interest

I, Binod Kumar Behera, hereby declare the following competing interests in relation to the manuscript titled "Financial hardship of Tuberculosis patients registered under National Tuberculosis Elimination Programme (NTEP) in rural India: A longitudinal study " submitted for consideration in the Indian Journal of Tuberculosis.

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"A cross-sectional study to assess stigma associated with tuberculosis in patients, family members, and health care staff in central India."

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ABSTRACT

Background: Stigma poses significant challenges to tuberculosis control efforts worldwide. India, bearing a substantial burden of tuberculosis cases, grapples with pervasive stigmatizing attitudes towards the disease, hindering timely diagnosis and treatment. This study aims to assess the prevalence and manifestations of tuberculosis-related stigma, shedding light on a critical yet overlooked aspect of tuberculosis management.
Methods: After obtaining informed consent, 314 participants were taken and stratified equally into three groups: patients, family members, and healthcare workers. A pre-designed questionnaire was used to calculate prevalence and assess tuberculosis stigma across various domains. Data were compiled in MS-Excel and analyzed using EPI-Info 7 by the CDC.
Results: Among all 314 participants, the prevalence of stigma in this study was 26.75%. A statistically significant correlation was found between stigma experienced and marital status ($p = 0.013$) and level of knowledge regarding tuberculosis ($p < 0.001$). Among the patients of tuberculosis, the odds of facing stigma are 13.25 (C.I. 95% 4.14, 42.41) times higher in females and 3 (C.I. 95% 1.005, 8.95) times higher in patients with unsatisfactory knowledge about tuberculosis compared to males and patients with satisfactory knowledge, respectively.
Conclusion: Tuberculosis is stigmatized due to its deviation from societal norms. Societal norms dictate what is deemed acceptable or unacceptable. Females with tuberculosis encounter more stigma than males, and knowledge about tuberculosis affects stigma significantly. Patients mostly experience enacted and perceived stigma, while family members face perceived and secondary stigma. Healthcare workers tend to exhibit secondary stigma.

1. Introduction

According to the World Health Organization Stigma can be understood as a negative label or judgment attached to certain individuals or groups, leading to their social rejection, discrimination, and exclusion from participating in various aspects of life.[1] Due to its serious social implications, Tuberculosis has always been a persistent problem throughout human history. Eight countries are responsible for two-thirds of all cases, with India leading the way.[2] Globally, an estimated 10 million people fell ill with TB in 2019; about 3 million of whom remained undiagnosed or unreported.[3] Currently, India contributes 27% of the global burden of TB.[4] Stigmatizing attitudes are present in 73% of the Indian population, and discriminatory attitudes toward persons with TB in 98%.[5] The stigma associated with Tuberculosis is frequently viewed as a substantial obstacle to getting medical help and a source of significant misery. Survivors of Tuberculosis and their family

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members interviewed for a survey, discussed the different ways in which stigma manifests itself: young women thrown out of their homes by husbands and families; children with TB physically isolated or prevented from sitting in the classroom; subtle exclusion by co-workers at the workplace; and discrimination by healthcare workers at health facilities in both the public and private sectors.[6] In an interview with The Sunday Guardian, a man diagnosed with TB in 2019 in Mumbai mentioned that he avoided his friends and family after being diagnosed with Tuberculosis. Many of his close friends used to tease and shun him, telling him that he was going to die.[7] It adds that the knowledge disseminated about TB is mainly medical and may not adequately address the factors that lead to stigma and discrimination against people with TB.[5] Delays in seeking care and delayed diagnosis driven by stigma increase the size of the infectious pool of Tuberculosis, increasing the risk of household contact transmission and community transmission.[8] As a result, reducing stigma is one of the cornerstones of TB transmission prevention. India's previous campaigns on TB have almost never focused on stigma. This study to measure stigma is based on the rationale that present data on prevalent stigma is insufficient, and doing so would reveal a new facet of the existing issues.

2. Material and methods

STUDY DESIGN: A cross-sectional study.

STUDY SITE: Bhopal district, Madhya Pradesh.

STUDY DURATION: The study was conducted over 2 months from August to October 2022.

SAMPLING: The sample size has been calculated based on the prevalence in the reference study, which is 73%.[5]

$$Sample\ size\ (n_0) = \frac{z^2 pq}{e^2}$$

p = prevalence = 73
q = 100-p = 27
e = allowable error = 5%
z = 1.96
confidence interval of 95%

$$n_0 = \frac{3.98 \times 73 \times 27}{(5)^2}$$

$$n_0 = 313.7$$

Thus, sample size (n_0) = 314. Stratified sampling was used to equally divide the sample size of 314 into 3 groups.

1. 105 patients
2. 105 family members
3. 104 health care workers

Table 1
List of Tuberculosis Units (TU) in Bhopal district.

S. No.	TU in Bhopal district	DMC in Bhopal district
1	DH Jaiprakash Hospital	2
2	Jawaharlal Nehru hospital	3
3	Civil Hospital Berasia	3
4	TB Hospital Bhopal	3
5	District TB Centre	3
6	Kailash Nath Katju hospital	2
7	AIIMS Bhopal	3
8	CHC Gandhi Nagar	2
9	Pulmonary Medicine Centre (Gas Rahat)	2
10	PHC Misrod	3
11	CHC Kolar	3
12	People's College of Medical Sciences & Research Centre	1
13	Civil Hospital Bairagarh	2

STUDY PLAN: Following clearance from the institutional ethical committee (IEC letter no. 30692/MC/IEC/2022, dated August 04, 2022) this cross-sectional study was carried out at 13 Tuberculosis units (TU) in the Bhopal district (Table 1). After obtaining permission from the District Tuberculosis Officer (DTO), the Nikshay portal was used to obtain a list of TB patients seeking treatment from the appropriate Tuberculosis unit, as well as their contact information.

105 patients were selected evenly among 13 Tuberculosis units in Bhopal district, based on a simple random sampling method. The investigator visited the patient's home and after receiving consent, interviewed the patient and one family member in the patient's home, preferably the primary caregiver, which was recorded in the questionnaire. After obtaining consent, 104 health care workers who provide Tuberculosis services were interviewed (Fig. 1). Each question/situation was translated into the local language without losing its original context and rendered in the way that the participant understood best. The participant's responses were assessed on a Likert scale of 5 based on how strongly they agreed or disagreed with the issue.

STUDY TOOL: Pre-designed questionnaire internally validated by pulmonologists and externally validated by the District Tuberculosis officer (DTO), made keeping in reference stigma assessment tool developed by the Stop TB partnership and hosted by UNOPS. Participants were questioned about their own experiences with TB-related stigma, as well as whether they had heard or seen others stigmatized; how stigma functions as a barrier to receiving TB services; and how TB services, laws, and policies should be improved. The following domains were covered in general by the questionnaire[9] (Fig. 2).

INCLUSION CRITERIA.

- TB patients aged greater than or equal to 18 years.
- Patients with clear communication, clear consciousness, and the ability to understand the contents of the questionnaire.
- Patients who consented to take part in this research and were able to openly share their perspectives on the issue.
- Family members more than 18 years of age who are residents of the same house, are primary caregivers and willing to participate.
- Health care workers currently working under NTEP and are willing to participate.

EXCLUSION CRITERIA.

- Individuals not consenting to participate.
- Individuals less than 18 years of age.

STATISTICAL ANALYSIS: Data was compiled in MS Excel and analyzed using EPI-Info 7 by the CDC. Multinominal regression was applied to see the determinants of stigma pertaining to the socio-demographic details of participants, various domains of stigma were assessed on a Likert scale ranging from strongly disagree (Score = 1) to strongly agree (Score = 5), and Chi-square was applied to see the association between stigma and different groups of participants.

DEFINITIONS:[9]

1. "Social distance is when someone tries to avoid a person with TB."
2. "Traditional prejudice is when someone stereotypes people with TB believing all people with TB are less valuable."
3. "Exclusionary sentiments refers to the wish to separate person with TB from everyone else, or deny them their rights."
4. "Negative affect refers to emotional reactions such as disgust or hatred toward person with TB"
5. "Treatment carryover is when people are afraid of people knowing they were treated for TB in the past. This is the perceived need for secrecy that may linger after a person recovers."

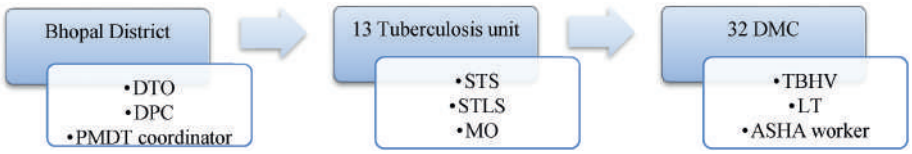

Fig. 1. National Tuberculosis Program healthcare workers organizational structure.

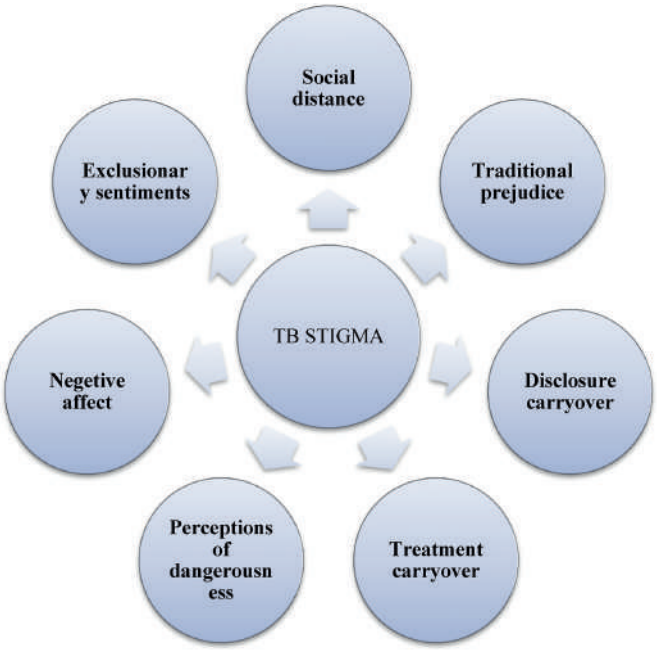

Fig. 2. Domains of Tuberculosis stigma.

6. "Disclosure carryover is when people are afraid of the reactions they would get if they were known to have TB."
7. "Perceptions of dangerousness is the idea that person with TB somehow represent a risk to society."
8. "Enacted stigma reflects the range of stigmatizing behaviors, messages, and effects that are either directly experienced by the person with TB or their families and/or that drive others to acts of discrimination, rejection, or isolation."
9. "Perceived stigma is the worry that one will be devalued after a TB diagnosis. For the person with a TB diagnosis, this is the fear that the stigma against the person will be so bad that it affects treatment. It may delay people from returning for care, or impact adherence to the prescribed drugs. Whether or not stigma actually occurs, anticipated stigma may interfere with care seeking and treatment adherence."
10. "Secondary stigma refers to the idea that caregivers, friends, family members, or health workers may expect negative attitudes or rejection because of their association with the disease and/or TB patients. Further, this may dictate their behavior or beliefs, regardless of whether the stigmatizing attitudes or reactions actually occur."

3. Observations and results

3.1. Section A

Figure A1 depicts the proportion of study participants that have experienced stigma due to having TB, family member diagnosed with TB, or working with TB patients. The prevalence of stigma in this study was 26.75%

Table A1 illustrates multinomial regression analysis of socio-demographic factors on stigma prevalence. Participants' mean age was 36.83 ± 12.77, dividing them into two groups. Males comprised 57.32% with 20% facing stigma, while females were 42.67% with 35.82% of them facing stigma. Gender-related stigma odds ratio was 1.55 (95% CI 0.83, 2.89), statistically insignificant ($p = 0.83$). Majority lived in non-slum areas (64.01%) and were married (82.16%), with 31% of the married ones facing stigma, significantly more than unmarried participants ($p = 0.013$). 93.3% were literate, with no significant association between socioeconomic status and stigma. Stigma odds significantly correlated with TB knowledge level ($p < 0.001$).

3.2. Section B

Table B1 displays multinomial regression analyzing socio-demographic factors' impact on stigma prevalence in TB patients. Participants' mean age was 42.19 ± 16.66. Males comprised 72.38%, with 4.76% facing stigma, while females were 27.62%, with 13.33% facing stigma. Females with TB were 13.25 (C.I. 95% 4.14, 42.41) times more likely to face stigma than males. A significant portion lived in non-slum areas (60.95%) and were ever married (70.47%), with 18.1% facing stigma. 84.7% were literate; 84.76% belonged to lower, upper lower and lower middle socio-economic status whereas 15.23% belonged to upper middle and upper class. Association of residence, marital status, education, and socio-economic status with stigma was insignificant. Stigma odds were 3 times higher with unsatisfactory TB knowledge, highly significant.

Figure B1 illustrates various stigma domains experienced by patients. **Social distance** was measured by asking if patients lost friends post-TB disclosure, with a mean score of 1.94. **Traditional prejudice** was gauged through fear of disclosing TB due to HIV association or guilt over lifestyle choices, scoring 2.13 and 2.3 respectively. **Disclosure carryover** was assessed by asking if patients carefully choose who to tell about their TB (mean score: 2.6). **Treatment carryover** was measured by patients' fear of visiting TB clinics (mean score: 1.6). **Negative effect**, reflecting upset caused by others' reactions to TB disclosure, scored 2.13. **Perception of dangerousness**, gauged through advice to maintain distance for TB prevention, scored 3.2.

3.3. Section C

Figure C1 delineates stigma domains among family members/caregivers of TB patients. Majority perceived infection risk (mean score: 4), reflecting **danger of infection**. **Shame** level was determined by asking if they felt humiliated due to a family member's TB; mean score: 1.9, indicating disagreement with feeling ashamed. **Treatment carryover**, assessed by worry of being seen at patient's clinic, scored 1.4, highlighting treatment awareness. **Disclosure carryover** was assessed by asking if they hide the fact that their family member has TB from the community (Mean score- 2.2), if their family member asks them to keep the TB a secret (Mean score- 1.8), if their family member hides his/her

TB diagnosis from the community (Mean score- 1.8), if they avoid talking about TB in the presence of other family members or neighbors (Mean score- 2), if they substitute another word for TB in conversations with my family member or friends (Mean score- 1.5). **Behavioural changes** post-diagnosis were noted by majority (mean score: 3.6), indicating observed stigma of caregivers for their patients.

3.4. Section D

Figure D1 presents stigma domains among healthcare workers in TB settings. Majority disagreed (mean score: 2.9) with **fear** of treating TB patients, indicating low fear levels. **Pity** for TB patients scored 3.9, while dislike for aiding them scored 2.5, suggesting willingness to **help**. **Avoidance** of TB patients scored 2.7. Most healthcare workers didn't **blame** patients for their condition (mean score: 2.9). **Anger** towards TB patients scored 2.1. Majority supported isolating TB patients during intensive treatment (mean score: 3.5) assessing **segregation**. To assess **danger**, they were asked if they believed that TB patients posed a threat, the mean score was 2.8. Majority agreed (mean score: 3.2) that TB treatment should be forced if necessary.

4. Discussion

This study investigated the prevalence of TB-related stigma across various domains in three groups, which was 26.75%. There was a significant association of marital status and knowledge regarding TB with stigma experienced in all three groups. Many studies have identified a significant burden of stigma in people living with Tuberculosis.[10–18]

When evaluating the association between several socio-demographic characteristics of patients and the stigma they experienced, gender and knowledge regarding TB indicated a significant association. Other variables like age (mean age $\pm$ SD = 42.19 $\pm$ 16.7), marital status, socio-economic status, residence area and education did not possess any noteworthy association with the stigma experienced. A study conducted by **Cremers AL et.al.** has shown that stigma affects men and women differently. There is a disproportionate effect on women, who are more prone than men to being stigmatized.[19] **Chen, X. et.al.** and **Dhingra VK et.al.** observed the detrimental effect on a female's marriage prospects and it is significantly greater than that of a male.[10,11] **Junaid et al.** indicated that 47.1% participants expressed concerns regarding the difficulty for individuals with TB to find a life partner even after being cured.[20] Younger women often hid their symptoms as a result of socio-cultural shame and restrictions.[12,13] Lack of knowledge regarding TB association with stigma was found significant in the studies conducted by **Chakrabartty A et.al.** in India, **Ali et.al.** in Pakistan, **Bresenham D et.al.** in South Africa and **Yin X et.al.** in China.[18,21–23]

Although this study did not demonstrate any association between the socioeconomic status of the patient and perceived stigma, a study by **Kamble BD et al.** showed lower socioeconomic classes faced higher stigma from family and friends.[14] Another study conducted by **Dhingra VK et.al.** showed stigma was more prevalent among middle and upper middle-class people as compared to lower middle class and lower class.[11]

The perception that TB patients were dangerous and should be kept at a distance was the most experienced domain in stigma. A significant number of patients experienced undesirable reactions from people after disclosing their disease, traditional prejudice that TB patients were less valuable, and were worried about the responses they would receive if it was known that they had TB. Treatment carryover and social distance were other domains observed by the patients. Research conducted by **Aryal S et.al.** revealed that nearly half (43.3%) of the individuals surveyed experienced social avoidance from their friends.[24] **Kamble BD et. al.** found that nearly half (45.5%) perceived stigma with family/friends and more than half (58.2%) perceived stigma at the workplace, almost half (45.5%) of patients had fear of disclosing the disease to their friends.[14] In a qualitative study conducted by **Yellapa V et al.** among TB patients in south India, it was reported that most participants tended to hide the disease status from relatives or neighbors.[25] **Atre SR et.al.** and **Dhingra VK et.al.** also found comparable results in their study.[11,26] 66% of participants of a study held the belief that individuals with TB should maintain distance from others to prevent the spread of germs, a sentiment consistent with the results of our study.[20] **Datiko DG et.al.** showed that most of the patients (75.3%) perceived that their utensils were separated.[27] **Zimmerman E et.al.** in their qualitative study found that patients believe that seeking care at a public health facility leads to others finding out that they have TB.[28] **Mohammedhussein M et al.** demonstrated a significant correlation between inadequate social support and the perception of stigma.[29] **Anand T et.al.** showed that 40% (n = 40) of patients experienced isolation from their families. Regarding the various ways of isolation by the family members, all were given separate utensils (n = 40; 100%). Out of the total 40 patients who faced isolation, 30 (75%) were reported to have been given separate rooms and 28 (70%) were asked to wash their clothes separately.[15] Study by **Muhandiki WD et.al.** identified common manifestations of community TB-related stigma such as isolation, mistreatment, denial of support, and reluctance to share housing, eating, and drinking utensils, findings that are echoed in our own study.[30]

In this study setting, a significant number of participants did not have confidence that the treatment provided was enough to be cured, and they were not satisfied with the TB-related counseling. This reflects the inefficacy of the health care system to properly counsel patients with stigmatizing diseases, hence having a detrimental effect on treatment adherence. This result differed from the results of **Getahun et.al.,** where sixty-seven percent of respondents were satisfied with the DOTS.[31] **Chakrabartty A et.al.** observed that stigma ($p = 0.001$) was found to be a very important factor to influence adherence to DOTS treatment.[18] Junaid et al. demonstrated that 16.2% of respondents expressed a reluctance to be seen visiting a TB clinic.[20]

Amongst the family members of TB patients, more than 70% agreed that they feared the danger of infection from the patient. On the bright side, the vast majority did not feel ashamed that a family member had TB, which will be encouraging to TB patients. **Datiko DG et.al.** showed the mean stigma score amongst the family members of TB patients was 20.46 (range: 10–46). Of the family members, 310 (38.0%) had high stigma scores. Additionally, they revealed that 9.3% of the patients agreed to have their family members avoid them.[27]

In this study setting, a vast majority of health care workers were not afraid to deal with TB patients, were sympathetic towards them, and did not refrain from providing assistance to TB patients. On the other hand, more than 50% of the health care workers believed that the patients should be separated, and treatment should be forced upon the patients. This frame of mind of the health care workers raises a concern about negative repercussions on their behavior towards the patients hence it may lead to reluctance in providing appropriate care and counseling. A study conducted by **Dodor EA et.al.** showed most health staff expressed feelings of fear when interacting with TB patients.[32] **Sima BT et.al.** discovered that a significant majority (66.7%) of healthcare professionals displayed negative attitudes towards patients with TB. The majority of the HCPs (75.9%) mentioned feeling compassion and a desire to help. 30.6% said yes to the statement that TB is a shameful disease. 23.1% feel like they would get infected, so they will make their conversation short. 8.3% feel like they have to keep their distance.[33]

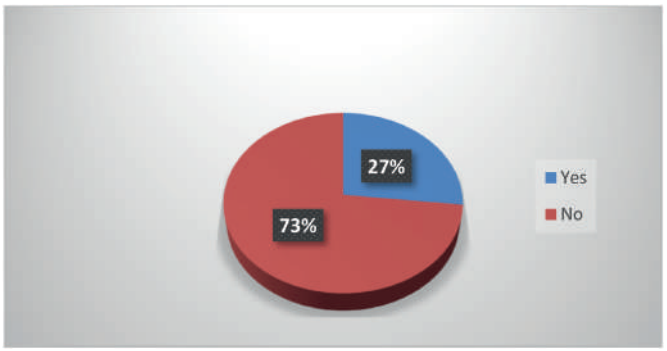

Fig. A.1. Prevalence of stigma in study participants

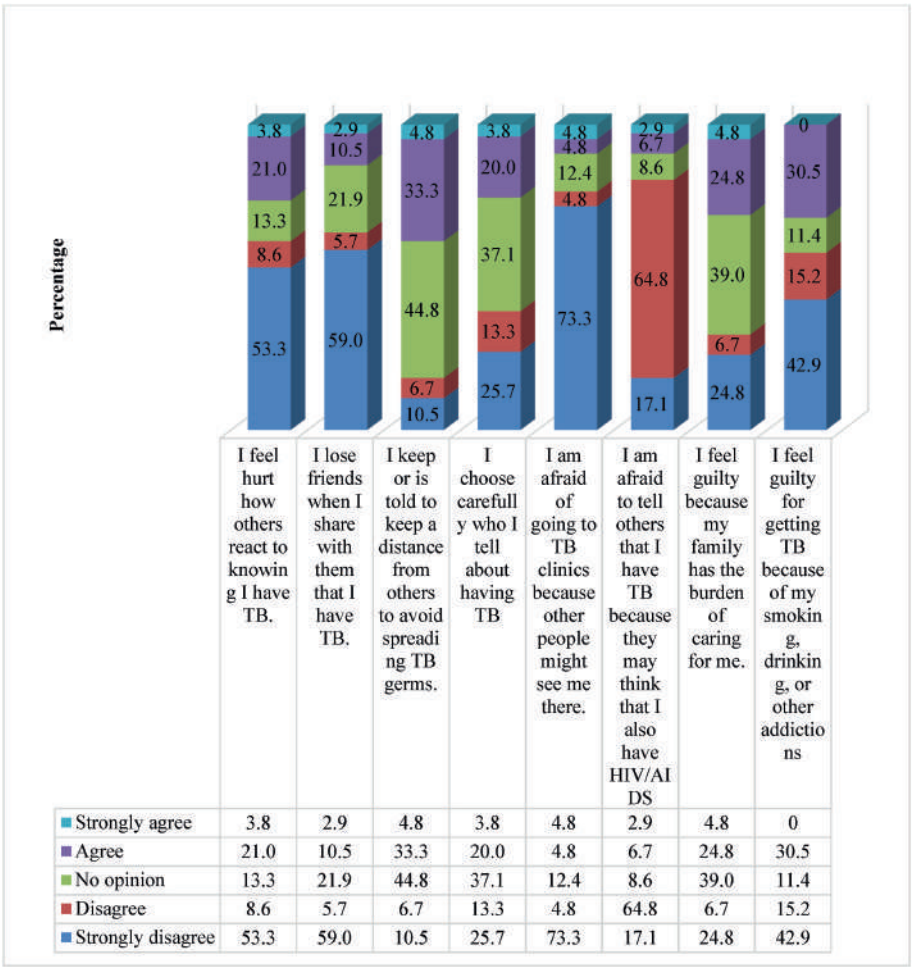

Fig. B.1. Proportional distribution of patients based on how they feel about tuberculosis (n = 10)

Table A.1
Association between socio-demographic variables and stigma experienced by study participants (n = 314)

		Have you ever faced stigmatizing behavior from others because of your TB status/family member having TB/having to work with TB patients		Total	Adjusted odds ratio	95% Confidence Interval		p-value
		No n (%)	Yes n (%)			Lower Bound	Upper Bound	
Intercept								0.28
Age (years)	≤37	150 (47.77)	43 (13.69)	193 (61.46)	1.73	0.978	3.053	0.060
	>37	80 (25.47)	41 (13.05)	121 (38.53)				
Gender	Male	144 (45.85)	36 (11.46)	180 (57.32)	1.55	0.830	2.893	0.169

(*continued on next page*)

Table A.1 (*continued*)

		Have you ever faced stigmatizing behavior from others because of your TB status/family member having TB/having to work with TB patients		Total	Adjusted odds ratio	95% Confidence Interval		p-value
		No n (%)	Yes n (%)			Lower Bound	Upper Bound	
	Female	86 (27.38)	48 (15.28)	134 (42.67)				
Housing type	Slum	79 (25.15)	34 (10.82)	113 (35.98)	0.88	0.498	1.547	0.652
	Non-slum	151 (48.08)	50 (15.92)	201 (64.01)				
Marital status	Ever married	178 (56.68)	80 (25.47)	258 (82.16)	0.25	0.082	0.743	0.013
	Unmarried	52 (16.56)	4 (1.27)	56 (17.83)				
Education	Illiterate	15 (4.7)	6 (1.91)	21 (6.68)	1.10	0.346	3.469	0.877
	Literate	215 (68.47)	78 (24.84)	293 (93.31)				
Socioeconomic status	Lower	114 (36.30)	39 (12.42)	153 (48.72)	0.54	0.278	1.032	0.062
	Middle and Upper	116 (36.94)	45 (14.33)	161 (51.27)				
Knowledge about TB	Satisfactory	149 (47.45)	32 (10.19)	181 (57.64)	3.28	1.689	6.377	0.000
	Non-satisfactory	81 (25.79)	52 (16.56)	133 (42.35)				
Total		230 (73.24)	84 (26.75)	314 (100)				

p-value< 0.05 is statistically significant.

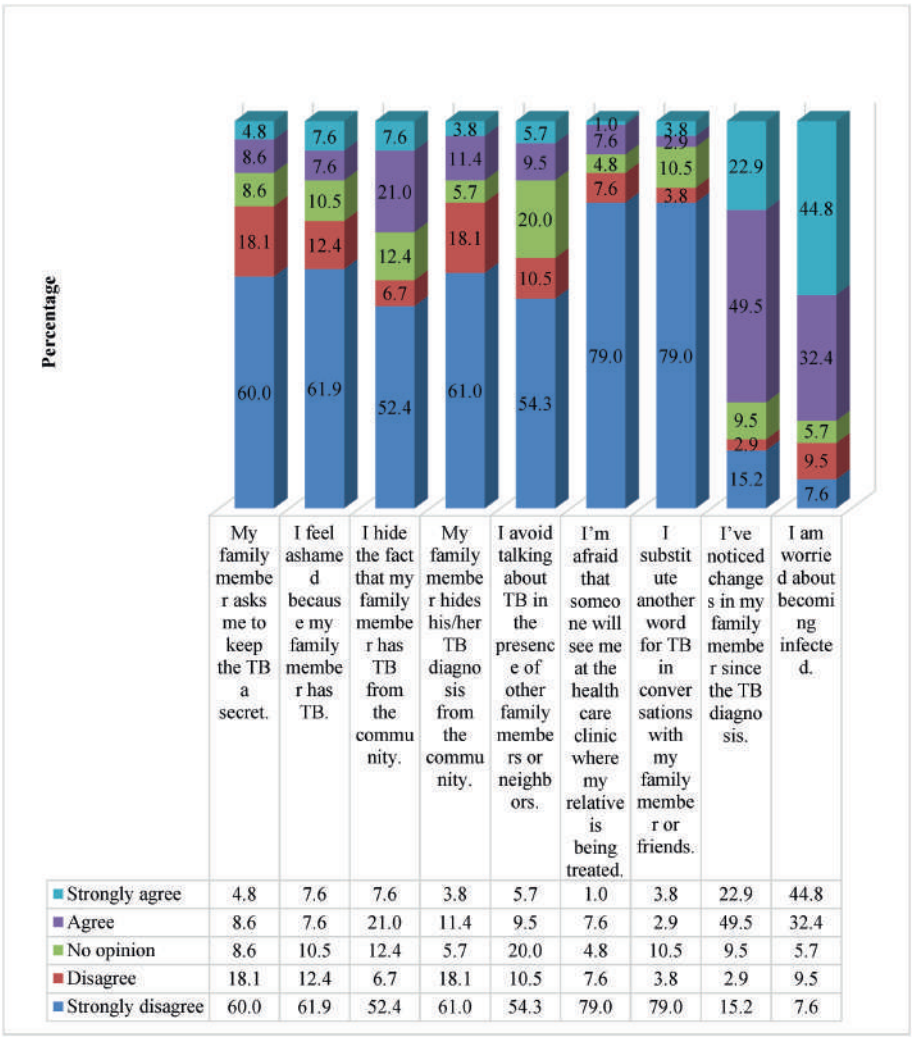

Fig. C.1. Proportional distribution of family members according to their feeling regarding tuberculosis (n = 105)

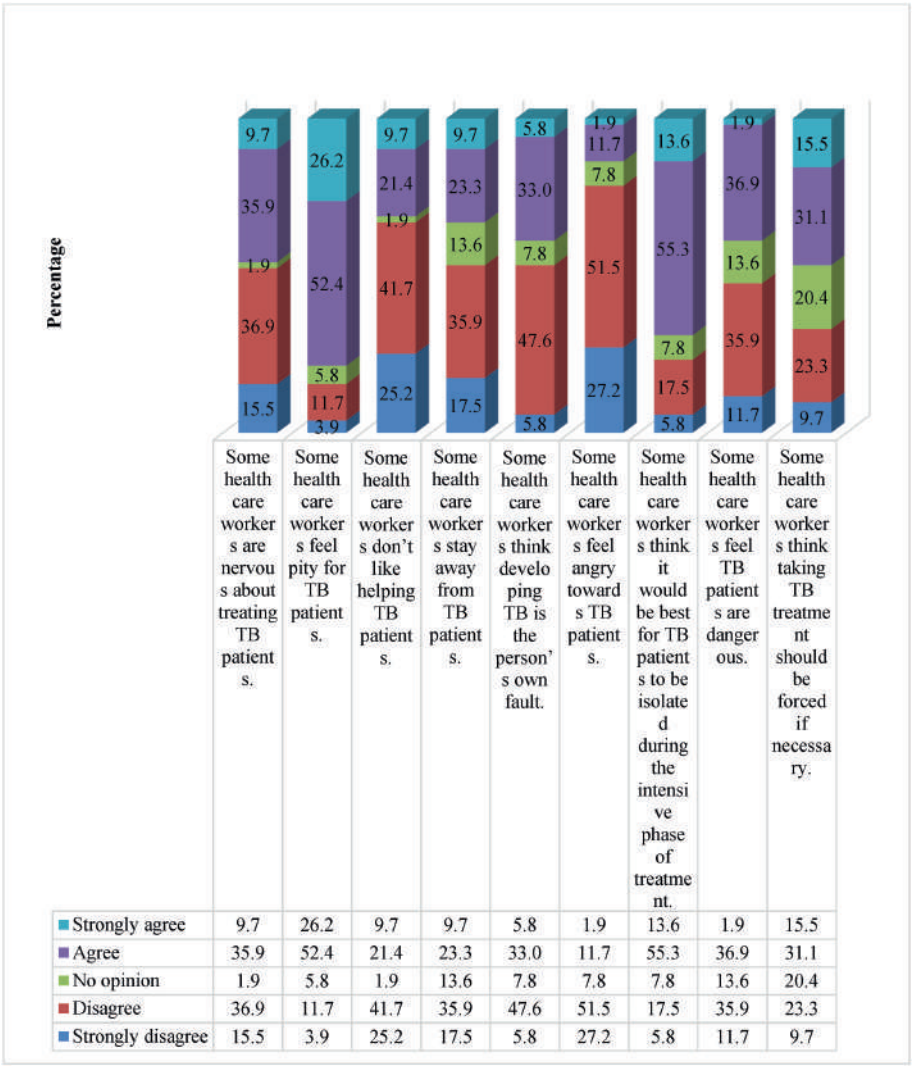

Fig. D.1. Proportional distribution of health care workers and their experiences related to tuberculosis (n = 104)

Table B.1
Association between socio-demographic variables and stigma experienced by patients (n = 105)

		Have you ever faced stigmatizing behavior from others because of your TB status		Total	Odds ratio	95% Confidence Interval	
		No n (%)	Yes n (%)			Lower Bound	Upper Bound
Age (years)	≤42	42 (40)	19 (18.1)	61 (58.1)	0.68	0.582	0.815
	>42	44 (41.9)	0 (0)	44 (41.9)			
Gender	Male	71 (67.61)	5 (4.76)	76 (72.38)	13.25*	4.14	42.41
	Female	15 (14.28)	14 (13.33)	29 (27.62)			
Housing type	Slum	30 (28.57)	11 (10.47)	41 (39.04)	0.39	0.14	1.07
	Non-slum	56 (53.33)	8 (7.61)	64 (60.95)			
Marital status	Ever married	55 (52.38)	19 (18.1)	74 (70.47)	0.74	0.65	0.85
	Unmarried	31 (29.5)	0 (0)	31 (29.5)			
Education	Illiterate	10 (9.52)	6 (5.7)	16 (15.23)	0.285	0.088	0.91
	Literate	76 (72.38)	13 (12.38)	89 (84.7)			
Socioeconomic status	Lower	70 (66.67)	19 (18.1)	89 (84.76)	0.78	0.706	0.87
	Middle and Upper	16 (15.23)	0 (0)	16 (15.23)			
Knowledge about TB	Not satisfactory	72 (68.57)	12 (11.42)	84 (80)	3*	1.005	8.95
	Satisfactory	14 (13.33)	7 (6.67)	21 (20)			
Total		86 (81.9)	19 (18.1)	105 (100)			

*The odds are statistically significant.

Declaration of competing interest

The authors declare the following financial interests/personal relationships which may be considered as potential competing interests: Mustansir Abbas Ali reports financial support was provided by Indian Council of Medical Research. If there are other authors, they declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Perceived causes and stigmatization of tuberculosis among Apatani tribe of Arunachal Pradesh

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A R T I C L E I N F O

Keywords:
Tuberculosis
Perceived cause of TB
Stigmatization of TB
Apatani tribe
Arunachal Pradesh

A B S T R A C T

Background: Tuberculosis (TB) is a pressing public health issue in many developing countries, with India having the highest number of cases. Lack of awareness and stigmatization of TB remains a significant barrier to addressing this challenge. This paper examines the perceived causes and stigma associated with TB among Apatani tribe of Arunachal Pradesh.

Methods: The study employed a mixed research approach, involving 106 TB patients (both pulmonary and extrapulmonary), both current and retrospective cases, from the Apatani tribe in Ziro valley, Arunachal Pradesh. Participants were selected from all the seven traditionally divided villages using purposive sampling. Semi-structured pre-tested schedules were used to conduct interviews with the patients.

Results: Among participants, 29.24% attributed TB to transmission, 34.91% had alternative explanations, and 35.85% remained uncertain about the causes. Notably, more Pulmonary TB patients reported transmission as the cause. A 10.75% higher likelihood of having misconceptions was observed among males. Literate individuals had 13.27% greater chance of being aware, although, higher education levels did not consistently follow this trend. Perceived stigmatization was evident mainly due to the contagious nature of the disease.

Conclusion: A significant knowledge gap was evident among TB patients, with very few having a clear understanding of the causes of this disease. Gender differences in this regard were minimal. Literate individuals were more likely to understand the causes. Additionally, perceived stigmatization was a notable concern in the study.

1. Introduction

Tuberculosis (TB) is a contagious disease caused by Mycobacterium Tuberculosis. It spreads through close contact with infected individuals who cough, sneeze, or speak forcefully. Factors affecting the risk of transmission include the number of infectious droplets, the duration of exposure, the virulence of the bacterial strain, ventilation, and the individual's immunity. Those frequently in contact with TB patients have a 22% risk of infection[1] and symptoms typically appear within 3–4 weeks. If left untreated, an infected person can transmit the disease to 10–15 or even more people annually.[2] Despite significant progress, TB remains a global health concern, with approximately 2 billion people carrying latent TB, 10 million developing active TB, and 1.5 million succumbing to the disease annually.[2] India leads this statistics with a quarter of global cases. TB inflicts socio-economic and psychological hardships, which are compounded by the rise of drug-resistant TB and the co-infection of TB with HIV.

Cross-culturally, beliefs regarding the causes of illnesses, especially persistent ones like TB, exhibit significant variation.[3] Previous research has shown that individuals may not readily associate TB symptoms such as chest pain with the disease[4] or its origin in the TB bacillus.[5] These beliefs encompass ideas like sweat drying, the evil eye, smoking, germs, and even witchcraft.[6,7] Recognizing and understanding these diverse views is crucial for comprehending patients' perspectives and their implications, which are influenced by personal, familial, and cultural backgrounds. Awareness of the causes of the disease plays a pivotal role in disease control. Patient beliefs can significantly impact their behavior, healthcare-seeking patterns, and treatment delays.[6,8]

TB patients face societal stigma from their families and communities, impacting health-seeking behavior and which sometimes result in the denial of essential services.[9] Perceived stigma includes discrimination, shame, and unworthiness, all of which can exacerbate health issues and increase the risk of disease transmission.[10,11] TB-related stigma manifests through various means, including social isolation, avoidance, verbal abuse, failed marriage prospects, and disregard from family.[12] Regions where TB is associated with HIV, poverty, and low social class

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tend to experience more pronounced stigma, particularly among those already vulnerable to health disparities, such as women, the impoverished, and those with lower levels of education.[13] The consequences of this stigma are multifaceted and can include non-disclosure of the disease, feelings of guilt, and struggles with mental health.[13]

The perception of TB causes differs among cultures, and successful treatment relies on patients' ability to identify the symptoms. While numerous studies have explored TB awareness within the general population, limited research has focused on diagnosed patients who are on treatment or have completed the anti-TB treatment. This study aims to understand the perceived causes of TB and the factors that influence them, as well as to assess enacted and perceived stigmatization among TB patients of Apatani.

2. Methods

The study utilizes a mixed research methodology, incorporating both qualitative and quantitative approaches to gain comprehensive insights. A total of 106 participants, comprising individuals currently undergoing treatment or those who have successfully completed treatment, were selected for this research. Data collection involved conducting semi-structured interviews using a meticulously designed research schedule. Well informed written consents were taken before conducting the interview. For minor patients consent were taken from their parents. The study was approved by Department Research Committee (DRC) as part of MPhil degree (M.Phil dissertation Certificate number: RGU/ANTH/MPhil/2021/03).

This study was conducted within the Apatani tribe of Ziro Valley, located in the district headquarters of Lower Subansiri district, Arunachal Pradesh. Eligible participants were individuals diagnosed with TB, irrespective of its form (pulmonary or extrapulmonary) at any point in their lives. The participants were selected from the recorded cases in District Tuberculosis Centre, however, household survey and snowball sampling techniques were also utilized to expand the number of participants. In cases where the participants were minors, parents or guardians were included as proxies to ensure their representation in the study. Total population of Apatani in Ziro Valley is 23,663, among this, total of 1132 houses were surveyed from all the traditionally divided seven villages i.e., Bulla, Hija, Hong, Hari, Dutta, Mudang Tage, and Bamin Michi villages.

This community has been chosen for this study because it is a homogeneous society with strong shamanistic culture, henceforth it would bring forward tailored approaches for TB elimination in this particular setting and also similar site elsewhere.

3. Results

3.1. Sample characteristics

Out of the interviewed 106 TB patients, 52 (49.06%) were male and 54 (50.94%) were female. Among these patients, 59 (55.66%) were diagnosed with pulmonary TB, while 47 (44.34%) had been diagnosed with extrapulmonary TB. 84.9% of these patients were diagnosed in govt. TB centre. The age composition, village wise classification, and educational qualifications of the patients are given in Table 1.

3.2. Perceived causes

Among the 106 patients interviewed, 29.24% believed that TB was caused by transmission, while 34.91% attributed it to personal reasons. The remaining 35.85% were uncertain about the cause. Remarkably, a significant majority, 70.76%, either held misconceptions or were uncertain about the cause of TB. When comparing pulmonary (PTB) and extrapulmonary (EPTB) cases, distinct perspectives on TB causes emerge. Among PTB patients, 37.29% attributed their condition to transmission, surpassing the 19.15% among EPTB patients. Conversely, PTB patients with personalized explanations were also 2.27% more prevalent. In contrast, among patients uncertain about the cause of their disease, 44.68% of EPTB patients expressed uncertainty, which is 15.87% higher than the uncertainty rate among PTB patients (Table 2).

Table 1
General profile of the participants.

Population (N = 106)	%
Sex wise distribution	
Male	49.06
Female	50.94
Age (year) wise distribution	
Below 20	5.66
21–30	37.73
31–40	24.52
41–50	10.38
51–60	15.10
Above 60	6.61
Village wise distribution	
Bulla	27.36
Hija	23.58
Hari	18.87
Hong	15.1
Dutta	6.6
Mudang Tage	6.6
Bamin Michi	1.89
Education wise distribution	
Illiterate	24.53
Class 10 and below	33.02
Class 10 above	42.45

This study noted no significant gender gap for patients citing transmission as the cause. Yet, for those attributing TB to personal causes, male reports exceeded females by 10.75%, while uncertain females surpassed males by 9.97%.

Literate patients reported transmission as a cause of TB in 32.5% of cases, while 28.75% cited personalized causes, and 38.75% expressed uncertainty. In contrast, illiterate patients had lower reports of transmission (19.23%), 53.85% mentions of personalized explanations, and a 26.92% rate of uncertainty. Literate individuals demonstrated a better understanding of TB causes, with 13.27% more attributing the disease to transmission and 25.1% fewer providing personalized reasons. However, the data also suggests that higher education didn't consistently lead to greater awareness about the causes of TB. Specifically, those classified as 'Class 10 above' had 8.25% lower rate of reporting transmission compared to those categorized as 'Class 10 and below,' and 7.93% more from the 'Class 10 above' group reported being uncertain about the cause.

3.3. Patients that perceived transmission to be the cause

Among the total patients interviewed, 31 individuals (29.24%) attributed their TB to transmission, believing it was acquired from others (Table 3). Their suspected sources of transmission included

Table 2
Perceived causes of TB for different variables.

Variables	Transmitted (%)	Other Cause (%)	Uncertain (%)
Pooled	29.24	34.91	35.85
Gender			
Male	28.85	40.38	30.77
Female	29.63	29.63	40.74
Patients with different types of TB			
Pulmonary	37.29	33.9	28.81
Extrapulmonary	19.15	36.17	44.68
Education Status of Patients			
Literate	32.5	28.75	38.75
Illiterate	19.23	53.85	26.92
Class 10 and below	37.14	28.57	34.29
Class 10 above	28.89	28.89	42.22

Table 3
Perceived source of infection.

Variables	%
Transmitted from (N=31)	
Family members	48.39
Hostel mates	16.13
Friends	12.9
Visitors	9.68
Neighbors	6.45
Strangers	6.45
Other Cause (N=37)	
Unhygienic lifestyle/food habit	24.32
Heredity	24.32
Prolonged cough	21.63
Prolonged pain	18.92
Overwork/inactive	10.81

family members (48.39%), especially when prior cases were present, hostel mates (16.13%), particularly students in lower classes who assumed risk due to close contact with hostel residents, friends (12.9%), and visitors (9.68%) as a father of diagnosed teenage son narrated.

> We did not have any cases of TB, I think someone from outside who already had the disease might have visited our house.

Furthermore, suspects were neighbors (6.45%), when they hear of positive cases nearby. When they were certain of transmission but without a clue of TB contacts, they suspected strangers (6.45%). A middle aged patient had narrated about the possibility of having infected from strangers during travelling.

> During the period when my husband was posted in Seppa (a place in Arunachal Pradesh), I found myself frequently traveling back and forth between Ziro and Seppa. Looking back, I believe I might have contracted an infection from other passengers during those journeys.

3.4. Patients that expressed other causes

A total of 34.9% of patients held misconceptions about the source of their TB infection, lacking awareness of the disease's contagious nature and subscribing to alternative beliefs regarding its transmission. Out of the 37 patients in this group, their explanations for acquiring the disease can be categorized as follows:

Attribution to Unhygienic Environment (24.33%): Patients in this subset linked their illness to various factors related to an unsanitary environment, including untidiness, alcohol consumption, smoking, unclean water and food, as well as insufficient food. Gender differences were generally minimal across the specific causes mentioned here, except for alcohol and smoking, which were predominantly cited by males as contributing factors. Some narratives were:

> I smoke and drink regularly due to which I have recurrent illnesses, that is probably how I acquired this disease.

> Water quality was dirty in my former residential colony, which must have been the origin of my infection.

> At the time of my diagnosis, our family struggled with food scarcity, and proper cleanliness was not upheld. These circumstances might have played a role in the onset of my illness.

Heredity (24.32%): Heredity was a factor for 24.32% of patients who believed they inherited TB from their parents. This suspicion frequently emerged when cases were prevalent within their immediate nuclear or extended family, whether on the paternal or maternal side. As patients narrated:

> Heredity is strong in my family. Both parents battled this ailment, and later, my younger brother and I were diagnosed.

> Starting with my mother, the diagnosis extended to my elder brother, me, and one sister. This hereditary trend includes many cousins too. I think this disease is hereditary in our lineage.

Prolonged cough (21.62%) and sustained illness or injury (18.92%): 21.62% of patients believed that an untreated, persistent cough had developed into TB, while 18.92% patients perceived prolonged bodily affliction as a precursor to the development of TB. Narratives went as such:

> I started feeling mild weakness all over and intermittent fever that lasted days. Overlooking these symptoms and delaying medical care might have contributed to TB's emergence.

> During a walk, I had a mishap, receiving a blow at my chest. Initially deeming it minor, I hoped it would heal naturally. Yet, persistent pain led me to seek medical help after four months, revealing a TB diagnosis.

> I speculate that frequent hits to my upper back during childhood misbehaviour might have developed in TB.

Over exertion/Lack of activity (10.81%): These patients associated their disease with either excessive work or extended periods of inactivity. Narrations were often expressed in the following manner:

> In the past, I used to play football a lot, but since I reached college, I had refrained from playing. Sedentary routine that I started to have must have been the reason behind development of TB.

One patient wondered whether her disease was caused by hard work or inactivity:

> TB might have developed because I worked too hard earlier, but it can also be because I have worked much lesser after child birth.

Patients those who were uncertain about the cause: Among all patients interviewed, approximately 35.85% (38 individuals) did not comment on or identify any sources of TB infection. Uncertain about the disease's contagious nature, this group refrained from speculating. Their hesitance highlights a lack of awareness about TB transmission, with females outnumbering males by 9.97% among these patients. They expressed as:

> I have no idea

> Don't know how I was infected with this disease

> Don't know how it started

3.5. Stigma

TB, linked to communicability, poverty, alcohol, and smoking, bears a stigma. In this study, patients often refrained from sharing their status due to fear of negative judgement from friends and neighbors. Forms of stigmatization found in this study include:

Enacted stigmatization: Upon a TB diagnosis, patients and families are grappled with distance rules. Often, patients dined separately, used distinct utensils, and even slept apart, especially if children were present. Apprehensions about transmission to children invariably arose whenever youngsters were present in the household. A father of three sons recounted isolating his eldest son, diagnosed at age 7, from his younger siblings:

> When my 7-year-old son was diagnosed with TB, my other two children were 4 and 1 year old. To safeguard the younger ones, I kept them apart. I shared a separate room and slept with the affected boy.

Such circumstances can lead to enacted stigmatization. In another instance, a woman blamed her son's use of alcohol and smoking as the cause of his TB and also for a relapse that had occurred in treatment. Such situation led to induced stigmatization.

Anticipated stigmatization: The fear of being stigmatized due to their TB-positive status underlies the anticipation of stigmatization by people. An example of this was clearly seen in a middle aged man who was diagnosed positive in a public hospital. This patient, in order to prevent his name from appearing in the record book at hospital, took permission from doctor and purchased the medicines from pharmacy. He said to the researcher:

> If you go and check, you won't find my name in the register of TB hospital.

3.6. Perceived causes and delay in help seeking

Fig. 1 illustrates the analysis of the relationship between perceived causes and starting of treatment. Among patients who attributed their disease to transmission, 64.5% sought healthcare within a month, while it is 75.68% for those who reported other personalized causes. In contrast, a lower percentage of patients who were uncertain about the cause (57.9%) sought healthcare within a month. This suggests that patients' awareness of the cause did not increase the likelihood of seeking healthcare earlier (Fig. 1).

4. Discussion

The study highlights the diversity in patients' beliefs regarding the origins of TB. Only a slightly smaller fraction, just under one-third of patients, attributed their TB to transmission, while the rest of the participants either held misconceptions or expressed uncertainty about the disease's cause. This suggests an insufficient awareness among TB patients in the study population, and it raises concerns about the comprehension of issue among the broader population. Notably, patients diagnosed with PTB displayed a higher level of awareness in comparison to EPTB patients, while a greater number of patients diagnosed with EPTB were uncertain about the disease's origin.

Among the one-third patients that believed they got TB from other person often had multiple cases of TB in their households. Moreover, if patients knew someone in close proximity who had TB, especially in the present or recent past, they were more likely to suspect transmission as the cause. However, the likelihood of suspecting heredity as the cause also increased when multiple cases were present in the family, aligning with findings from earlier studies.[14]

It was observed in this study that nearly one-third of the patients cited personalized explanations as the cause of their disease. Many patients attributed their illness to living in unclean environments, consuming contaminated food, or experiencing insufficient food intake, while some considered TB a waterborne disease. These findings align with earlier research.[14] Moreover, smoking and alcohol consumption were frequently perceived as causes, particularly among males, who are more likely to engage in these behaviors, as also noted in previous studies.[6,14,15] Hard work and fatigue were also mentioned as the origin, and although some studies suggested a higher number of females reporting hard work,[7] this study found both male and female patients citing fatigue or overwork as possible contributors to their TB. On the contrary, some patients also reported becoming physically inactive as the cause. Additionally, a few patients mentioned prolonged coughs and external injuries to the chest, neck, and upper back as factors leading to TB. Notably, unlike certain earlier studies, our research did not reveal mentions of causes such as exposure to hot or cold,[14] witchcraft,[5] curses,[7] or sweat drying on one's back.[6]

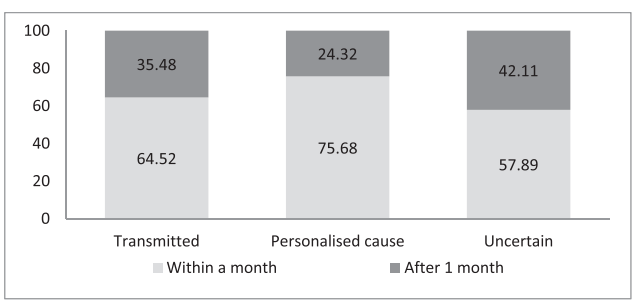

Fig. 1. Time taken to start the treatment.

A study by Sagili et al.[16] had reported that stigma was present in three-fourths of the Indian population, and it was manifested in both family and community levels. Community perceptions of TB can significantly impact the daily lives of patients, influencing their interactions with family members, neighbors, and colleagues.[17] In this study, patients maintained distance at homes and hesitated to disclose their condition to friends and neighbors due to the anticipated stigma. Similar patterns were observed in other studies[18,19] highlighting patients' reluctance to share their illness with both friends and extended family members. In a related context, a study by Rie et al.[20] reported that 63.3% of patients expressed reluctance. However, this study did not find instances of enacted stigmatization, such as avoidance by friends and family, verbal abuse from extended family and neighbors, marriage cancellations, or concerns about mistreatment after marriage due to a history of TB, and worries about a decline in marital prospects which were reported in other studies.[18,19,21]

Furthermore, Literate patients demonstrated a better grasp of TB causes, which is constant with earlier studies,[7] but intriguingly, higher education levels did not consistently lead to greater awareness about causes of TB. One of the most complex findings pertains to the relationship between perceived causes and healthcare-seeking behavior. It was discovered that patients' beliefs about the cause did not consistently impact the timing of their healthcare-seeking behavior. Gender disparity was not prominently observed in this study. Both males and females exhibited similar understanding of the causes, and gender-specific stigmas were not particularly prevalent. Though, it was observed that males were more inclined to attribute TB to personal causes, while females tended to express a higher degree of uncertainty regarding its causes.

5. Conclusion

There is a lack of adequate knowledge among the patients regarding its causes. Patients diagnosed with PTB and EPTB showed similar knowledge levels regarding its contagious nature. Literate patients demonstrated better understanding of TB causes, but higher education levels did not consistently correlate with greater awareness. Stigmatization was a concern, as patients reported being hesitant to disclose their condition to others. Overall, gender disparity was minimal, but males tended to attribute TB to personal causes.

6. Recommendations

The findings in this study suggest for tailored strategies that address the complexities to improve TB awareness, reduce stigma, and promote early diagnosis and treatment, ultimately contributing to the control and prevention of tuberculosis. To enhance the knowledge of both patients and the broader community, it is imperative to intensify training for healthcare workers at the grassroots level. Such programs should also be furthered to make it inclusive, targeting individuals across all education levels to ensure a thorough understanding of TB. Stigma can lead to delayed diagnosis and treatment, necessitating anti-stigma campaigns and community support for TB patients. Gender differences may be influenced by cultural or societal factors, emphasizing the importance of gender-sensitive health interventions that address varying perceptions and needs.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Socio-demographic factors & adherence of newly diagnosed pulmonary tuberculosis patients to the newly introduced daily regimen: A hospital survey based follow up study

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A R T I C L E I N F O

Keywords:
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A B S T R A C T

Introduction: Poor adherence to anti-tuberculosis medication is a major barrier to its global control. Patient adherence to the standard anti-TB therapy (ATT) in developing countries has been estimated to be as low as 40%. Multiple factors influencing adherence to treatment are:
Economic and structural factors such as homelessness, unemployment and poverty; patient related factors like ethnicity, gender, age, knowledge about TB, cultural belief systems, mental state etc.
Aims & objectives: This study was planned with the aim to study the association between various socio-demographic factors with level of adherence to the daily regimen amongst newly diagnosed pulmonary TB patients at a tertiary care hospital in metropolitan city of Maharashtra. Additionally, we tried to determine the type of non-adherence along with reasons for it.
Method: ology: An interview based pre-tested and validated questionnaire was developed & used as data collection tool. Total 181 newly diagnosed, FDC naïve, drug sensitive pulmonary TB patients from DOT center of a tertiary care hospital were enrolled & interviewed for sociodemographic, treatment & adherence details. They were followed up at 2nd & 6th month of their treatment, i.e., IP & CP follow up. Their Nikshay portal data & TB treatment cards were accessed for information on treatment adherence.
Results: Out of 181 patients, 110 (60.8%) were found to be adherent whereas 71 (39.2%) were found to be non-adherent. Among those non-adherent, 64 (90.9%) had treatment gaps (intermittent missed doses) & 7 (9.9%) showed discontinuation of treatment. Majority of these patients reported personal obligations & starting to feel better as the main reason for non-adherence ($p < 0.0001$). The sociodemographic factors that had significant impact on level of adherence were patients' age ($p = 0.013$); level of education ($p = 0.035$); family size ($p = 0.018$); family history of TB ($p = 0.0001$) & current smoking habit ($p = 0.025$).
Conclusion: It is evident from the study that socio-demographic factors do have a major impact on patients' levels of adherence to treatment. Family history of TB as well as sputum conversion at end of treatment/CP have been identified as independent risk factors among pulmonary TB patients who are non-adherent to treatment. Thus, ensuring robust availability of DBT & intensive tobacco cessation sessions for all diagnosed patients as well as strengthening system for making prophylaxis available for household & close contacts of patients can help in reducing impact of socio-demographic factors & improving adherence levels.
Recommendations: In-patient care option specifically during IP; regular dietary counseling to improve nutrition & help reduce drug side effects & use of alternate adherence technologies like facility-based DOT or Video Observed Therapy (VOT) wherever feasible can help to improve adherence levels for TB patients from all walks of life.

1. Introduction

Despite being a disease of antiquity that is largely curable with affordable treatment, yet in 2022, tuberculosis (TB) was the world's second leading cause of death from a single infectious agent, after coronavirus disease (COVID-19), and caused almost twice as many deaths as HIV/AIDS. More than 10 million people continue to fall ill with TB every year. The reported global number of people newly diagnosed

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with TB was 7.5 million in 2022. This is the highest number since WHO began global TB monitoring in 1995, above the pre-COVID baseline (and previous historical peak) of 7.1 million in 2019, and up from 5.8 million in 2020 and 6.4 million in 2021. The number in 2022 probably includes a sizeable backlog of people who developed TB in previous years, but whose diagnosis and treatment was delayed by COVID-related disruptions that affected access to and provision of health services. Globally in 2022, TB caused an estimated 1.30 million deaths (95% UI: 1.18–1.43 million) with an estimated 10.6 million people (95% UI: 9.9–11.4 million) developing TB in 2022. The estimated TB incidence rate (new cases per 100,000 population per year) was 133 (95% UI: 124–143). TB affects people of both sexes and all age groups, but in 2022, around 55% of people who developed TB were men, 33% were women and 12% were children (aged 0–14 years). Geographically, 30 high TB burden countries accounted for 87% of the world's TB cases in 2022 and two-thirds of the global total was in eight countries of which India was a leading contributor with a whopping 27% TB cases.[1]

India is the top contributor to Global TB burden having an estimated incidence of India is the highest TB burden country in the world having an estimated incidence of 26.9 lakh cases in 2019 (WHO) which amounts to estimated incidence rate of 199 cases per lakh population. In Maharashtra, 2, 11,971 TB patients were initiated on treatment (public and private sector), out of which 1, 40,986 were initiated through public sector.[2]

In 2017, WHO released an update about guidelines for treatment of drug-susceptible TB and patient care, and the major recommendations stated were as follows:

Firstly, in patients with drug-susceptible pulmonary TB, 4-month fluoroquinolone containing regimens should not be used and the 6-month rifampicin-based regimen 2HRZE/4HR remains the recommended regimen.

Secondly, the use of fixed-dose combination (FDC) tablets is recommended over separate drug formulations in treatment of patients with drug-susceptible TB.

Thirdly, in all patients with drug-susceptible pulmonary TB, the use of thrice-weekly dosing is not recommended in both the intensive and continuation phases of therapy, and daily dosing remains the recommended dosing frequency.

And lastly, the recommendations stated that community- or home-based directly observed treatment (DOT) is recommended over health facility-based DOT or unsupervised treatment.

Evidence showed that when thrice-weekly dosing throughout therapy was compared to daily dosing throughout therapy, patients who received thrice-weekly dosing had a higher risk of treatment failure, disease relapse and acquired drug resistance in both drug-susceptible disease and when the strain susceptibility was unknown. Consequently, it was suggested that thrice-weekly dosing in the intensive phase should never be used. Likewise, when thrice-weekly dosing during the continuation phase only is compared to daily dosing throughout, there were higher rates of treatment failure and relapse in the patients that received thrice-weekly treatment during the continuation phase.[3]

Thus, following the lead of these recommendations by WHO, the Daily regimen was initially rolled out in five states in India, namely Sikkim, Maharashtra, Kerala, Himachal Pradesh & Bihar in first quarter of 2017. However, following the directions of Honorable Supreme Court of India to roll-out daily drug regimen across the country by October 2017; the programme with support of the Central & State authorities successfully rolled out daily drug regimen for patients diagnosed in Public sector since 30th October 2017 throughout the country. The drug sensitive TB patients (adult & pediatric) are now being treated across the country with daily regimen drugs (FDCs).[4]

Each year, we commemorate World Tuberculosis Day on March 24 to raise public awareness about the devastating health, social and economic consequences of TB, and to step up efforts to end the global TB epidemic. The date marks the day in 1882 when Dr Robert Koch announced that he had discovered the bacterium that causes TB, which opened the way towards diagnosing and curing this disease. The theme of World TB Day 2021 - 'The Clock is Ticking' –conveys the sense that the world is running out of time to act on the commitments to end TB made by global leaders. This is especially critical in the context of the COVID-19 pandemic that has put End TB progress at risk. This has also adversely affected the equitable access to prevention and care in line with WHO's drive towards achieving Universal Health Coverage as well as the Sustainable Development Goal 3 (SDG 3.3) of ending the epidemic of TB.[5] For India, the clock is indeed ticking considering that The Government of India has committed to achieve the SDG goal of eliminating TB in the country by 2025, five years ahead of the Global Target. In light of this ambitious target and to accelerate momentum towards the ultimate goal, it was decided to rename the programme as "National Tuberculosis Elimination Program (NTEP)" from "Revised National Tuberculosis Control Program (RNTCP)".[2] Efforts at increasing patients' adherence to treatment would play a vital role in inching a step closer to the ambitious deadline set by India.

In terms of TB control, adherence to treatment may be defined as the extent to which the patient's history of therapeutic drug-taking coincides with the prescribed treatment. Tuberculosis is a communicable disease, thus poor adherence to prescribed treatment increases the risks of morbidity, mortality, poor treatment outcomes as well as drug resistance, at both, the individual and community levels. Poor adherence to anti-tuberculosis medication is a major barrier to its global control. Patient adherence to the standard anti-TB therapy (ATT) in developing countries has been estimated to be as low as 40%.[6] Multiple factors influencing adherence to treatment are:

Economic and structural factors such as homelessness, unemployment and poverty; Patient related factors like ethnicity, gender, age, knowledge about TB, cultural belief systems, mental state; Regimen complexity; Supportive relationships between the health provider and the patient and; Pattern of health care delivery which comprises of the organization of clinical services, including availability of expertise, links with patient support systems, flexibility in the hours of operation, and staff lacking required skills.[7]

Against this backdrop, this study was planned to study the association between various socio-demographic factors and treatment outcomes with adherence to the daily regimen amongst newly diagnosed pulmonary TB patients at a tertiary care hospital in metropolitan city of Maharashtra.

2. Aims and objectives

2.1. Aim

To assess the adherence of the newly diagnosed, sputum positive, drug-sensitive pulmonary tuberculosis patients to the daily regimen & it's the association with various socio-demographic factors as well as determination of the reasons for non-adherence to daily regimen.

2.2. Objectives

- To assess level of adherence to daily regimen;
- To study the association of level of adherence with socio-demographic factors;
- To determine the type of non-adherence to daily regimen;
- To determine the reasons for non-adherence to daily regimen.

3. Methodology

3.1. Materials and methods

1 **Study Design:** Hospital based survey prospective follow up study.
2 **Study Area:** Directly Observed Treatment (DOT) centre of a tertiary care hospital in a metropolitan city.
3 **Study Material:** Predesigned, pretested and validated questionnaire

4 **Duration of Study:** Total duration of study was 2 years and 3 months, September 2018 to December 2020

5 Sample Size:

The Following formula was used for sample size calculation:[8]

$n = [(Z_{1-\alpha/2})^2 \times p \times q] / d^2$

n = Size of the sample.

$Z_{1-\alpha/2}$ = Standard normal deviate for α

p = Anticipated population prevalence

d = Absolute precision required on either side of the proportion.

In the current study,

Z 1- α/2 = 1.96 (for α = 0.05)

p = 13.67 %[9]

d = 5 %

So, the sample size came out to be **181**.

6 Inclusion Criteria:

a) Microbiologically confirmed, i.e., sputum smear positive, drug sensitive pulmonary TB patients who were newly registered at the DOT centre and were FDC naïve.
b) Sputum smear positive TB patients who are more than 18 years of age.
c) Sputum smear positive TB patients willing to participate in the study.

7 Exclusion Criteria:

a) Sputum smear positive TB patients who are less than 18 years of age.
b) Sputum smear positive pulmonary TB patients who have been on ATT in the past.
b) Extrapulmonary TB patients.
c) DR-TB patients.
d) Clinically/radiologically diagnosed TB patients.
e) Sputum smear positive pulmonary TB patients who are not willing to participate in the study.

8. **Sampling Method:** Universal consecutive consenting sampling, i.e., all patients meeting the inclusion criteria were enrolled in the study after taking their consent. Patients were enrolled till the sample size was met.

9 Method of Data Collection:

- Newly diagnosed, microbiologically confirmed, FDC naïve, drug sensitive Pulmonary TB patients who were initiated on Daily regimen at DOT centre were followed up at 2nd and 6th month during their treatment period. In this study, newly diagnosed patients were the ones who were never treated for TB in the past.
- Adherence to daily regimen was measured by means of Nikshay calendar of the patients and also tallied with their TB treatment cards.
- Patients were classified as non-adherent if they missed ≥10% of the total prescribed doses.[10]
- Non-adherence was further categorized as follows:[11]
  a) Discontinuation, which documented the cessation of treatment, i.e., discontinuation of treatment before the last prescribed dose.
  b) Suboptimal Implementation, i.e., intermittent missed doses (treatment gaps); signifying non-adherence arising from how individuals implement their own medication.

10. **Data Collection Tool:** An interview based pre-tested and validated questionnaire was developed under expert guidance. This was used as a data collection tool. The questionnaire contained information regarding following aspects:
    - General information
    - Socio-demographic factors
    - Personal history
    - Family history
    - Clinical profile and records
    - Co-morbid conditions
    - Adherence details
    - Treatment outcome details
11. Kuder- Richardson test & Cronbach Alpha test were used for reliability & validity of the study questionnaire.
12. It was explained to all study participants that the information would be kept confidential. The research was a part of thesis dissertation and the results would be used for improving services.
13 . Study population was from a tertiary care hospital in a metropolitan city. Proforma were filled by the interviewer. Written informed consent was sought from the study participants. Patients were followed up for a period of 6 months. Two follow up visits were done during the period, preferably at time of scheduled sputum examination, viz., at 2 months denoting the end of IP and at 6 months denoting the end of CP. At the time of follow up, each interaction with the patient was used as an opportunity to educate the patient and their relatives. They were educated about importance of proper nutrition, hygiene, with special emphasis on adherence to treatment. If clinical condition of the patient deteriorated, they were advised to visit the DOT centre or nearest health services.
14. Institutional ethical committee approval was obtained before the start of the study.
15 Statistical Analysis:

3.2. Qualitative data

a) Pearson's chi-square test was applied to test the relationship of categorized independent and dependent variables.
b) If expected number in the cell was below 5 in a table, Fisher's Exact Test (Exact Two sided) was used.
c) Odds ratios (OR) and their 95% Confidence intervals (95% CI) were calculated.
d) If in a 2 × 2 table, any cell has 0 values, Odds ratios and their 95% Confidence intervals could not be calculated.
e) To examine the relationship of each independent variable with the dependent variable group which classifies patients as adherent or non-adherent, Binary Logistic Regression was performed. This procedure examines above relationship after accounting for interaction, collinearity, and confounding. Entry into the analysis was for variables with $p < 0.1$.
f) The fit of the mathematical model used was assessed by ROC Curve (Receiver Operating Characteristic Curve) analysis including area under curve of the fitted model, classification statistics, and Hosmer & Lemeshow test.
g) A p value (significance) of <0.05 is deemed statistically significant
h) A significance of 0.000 should be read as $p < 0.0001$ (Very Highly significant) as the software can detect significance up to 3 decimal points only

3.3. Quantitative data

a) Mean, Standard deviation, Standard error, 95% Confidence intervals were calculated. If the variable is not normally distributed, Median and Interquartile range were used.
b) Normality of data was assessed by the Shapiro-Wilk procedure.
c) Unpaired 't' test was used to compare quantitative variables individually with adherence status.
d) Mann Whitney *U* test was used to test variables that were not normally distributed with adherence status.
e) Box Plots were used for depicting non-normal variables with adherence status
f) Error bars were used for depicting normally distributed variables with adherence status.

SPSS 27.0 and Microsoft Excel were used to code and analyze the

Table 1
Final adherence status of patients.

Adherence status	Total	Percentage
Adherent	110	60.8
Non-adherent	71	39.2
Total	181	100

Table 2
Type of non-adherence among patients who were non-adherent to treatment.

Type of non-adherence	Total	Percentage
Discontinuation	07	9.9
Intermittent missed doses (Suboptimal implementation)	64	90.1
Total	71	100

Table 3
Age distribution of patients & adherence status.

Age of patient (years)	Adherence status		Total
	Adherent	Non- adherent	
18–30	48 (71.6)	19 (28.4)	67
31–40	15 (38.5)	24 (61.5)	39
41–50	17 (68)	08 (32)	25
51–60	17 (65.4)	09 (34.6)	26
> 60	13 (54.2)	11 (45.8)	24
Total	110 (60.8)	71 (39.2)	181 (100)

Note: Figures in parenthesis in the table indicate row-wise percentages.
Pearson $\chi^2 = 12.683$, df = 4, p = 0.013 (Sig).

data. STATA 13.1 was used for mathematical modeling and regression analysis.[12,13]

4. Results

Please refer to necessary table/s.

5. Discussion

This study was conducted at a DOT centre of a tertiary care hospital from September 2018 to December 2020. The study design was a survey follow up study with 181 participants enrolled in the study.

Microbiologically confirmed, newly diagnosed, drug sensitive pulmonary TB who were never on ATT in the past and were more than 18 years of age were included in the study.

These enrolled patients were followed up at 2nd month and 6th month during their treatment period.

The study was done to determine the level of adherence; type of adherence; reasons for non-adherence & to study the effect of various socio-demographic factors like level of education, socio-economic status etc on the level of adherence to the daily regimen.

It was seen that 110 (60.8%) of 181 patients were adherent to treatment whereas 71 (39.2%) were not adherent to the treatment. Similar finding was seen in other studies too (Table 1).[7,10,14,15]

The type of non-adherence observed among majority (90.1%) patients who were non-adherent was intermittent missed doses (suboptimal implementation) and discontinuation (9.9%) in the rest (Table 2).

Table 4
Age of patient and Adherence status.

Adherence status	Age of patient (years)			p value
	Mean	SD	95% CI	
Adherent	37.65	16.45	34.57–40.72	0.210 (NS)
Non- adherent	40.72	15.46	37.12–44.31	

Unpaired *t*-test (two tailed), t = −1.256, df = 179, p = 0.210 (NS).

Table 5
Gender of patients and Adherence status.

Gender of patients	Adherence status		Total
	Adherent	Non- adherent	
Male	64 (56.1)	50 (43.9)	114
Female	46 (68.7)	21 (31.3)	67
Total	110 (60.8)	71 (39.2)	181 (100)

Note: Figures in parenthesis in the table indicate row-wise percentages.
Pearson $\chi^2 = 2.773$, df = 1, p = 0.096 (NS) OR (95% CI) = 0.58 (0.31–1.1).

Table 6
Address (duration) of patients and Adherence status.

Address	Adherence status		Total
	Adherent	Non- adherent	
Residing at address since > 2 years	94 (57.7)	69 (42.3)	163
Residing at address since ≤ 2 years	16 (88.9)	2 (11.1)	18
Total	110 (60.8)	71 (39.2)	181 (100)

Note: Figures in parenthesis in the table indicate row-wise percentages.
Pearson $\chi^2 = 6.627$, df = 1, p = 0.01 (Sig) OR (95% CI) = 0.17 (0.04–0.77).

Table 7
Marital status of patients and adherence status.

Marital status of patients	Adherence status		Total
	Adherent	Non- adherent	
Married	77 (57.9)	56 (42.1)	133
Unmarried & others	33 (68.7)	15 (31.3)	48
Total	110 (60.8)	71 (39.2)	181 (100)

Note: Figures in parenthesis in the table indicate row-wise percentages.
Pearson $\chi^2 = 1.743$, df = 1, p = 0.186 (NS) OR (95% CI) = 0.63 (0.31–1.26).

This was in line with the non-adherence patterns observed in other studies.[16,11]

A majority of patients i.e. 69 (37%) were in the age group of 18–30 years followed by 39 (21.5%) in 31–40 years age group and 26 (14.4%), 25 (13.8%), 24 (13.3%) respectively in the age groups of 51–60 years, 41–50 years and >60 years. It was observed that majority of patients in 18–30 years age group were adherent (71.6%) as compared to patients in other age groups (Tables 3 and 4). This difference was found to be statistically significant. (p = 0.013). The finding was also seen in other studies.[17,18]

Among 181 PTB patients, 114 were males and 67 were females. It was observed that proportion of females being adherent (68.7%) was more than that among males (56.1%) (Table 5). But this finding was statistically not significant.[17,19]

The patients residing at their current address since ≤2 years duration showed greater adherence (88.9%) than patients residing at their current address for >2 years duration and this association was found to be statistically significant (p = 0.01) (Table 6). An Indian study had a finding akin to this.[7]

Patients who were unmarried/widowed/separated (68.7%) were observed to be adherent to treatment as compared to patients who were

Table 8
Religion of patients and Adherence status.

Religion of patients	Adherence status		Total
	Adherent	Non- adherent	
Hindu	58 (58.6)	41 (41.4)	99
Muslim & others	52 (63.4)	30 (36.6)	82
Total	110 (60.8)	71 (39.2)	181 (100)

Note: Figures in parenthesis in the table indicate row-wise percentages.
Pearson $\chi^2 = 0.438$, df = 1, p = 0.507 (NS) OR (95% CI) = 0.816 (0.447–1.489).

Table 9
Level of education and Adherence status.

Level of education of patients	Adherence status		Total
	Adherent	Non-adherent	
Up to high school (including illiterate)	78 (56.5)	60 (43.5)	131
Intermediate & above	32 (74.4)	11 (25.6)	43
Total	110 (60.8)	71 (39.2)	181 (100)

Note: Figures in parenthesis in the table indicate row-wise percentages.
Pearson $\chi^2 = 4.404$, df = 1, p = 0.035 (Sig) OR (95% CI) = 0.45 (0.21–0.96).

Table 10
Employment status and Adherence status.

Employment status	Adherence status		Total
	Adherent	Non- adherent	
Employed	57 (56.4)	44 (43.6)	101
Unemployed	53 (66.3)	27 (33.7)	80
Total	110 (60.8)	71 (39.2)	181 (100)

Note: Figures in parenthesis in the table indicate row-wise percentages.
Pearson $\chi^2 = 1.803$, df = 1, p = 0.179 (NS) OR (95% CI) = 0.659 (0.359–1.212).

Table 11
Family size and Adherence status.

Family size	Adherence status		Total
	Adherent	Non- adherent	
0–4 members	50 (52.6)	45 (47.3)	95
> 4 members	60 (69.8)	26 (30.2)	86
Total	110 (60.8)	71 (39.2)	181 (100)

Note: Figures in parenthesis in the table indicate row-wise percentages.
Pearson $\chi^2 = 5.56$, df = 1, p = 0.018 (Sig) OR (95% CI) = 0.481 (0.261–0.887).

married (57.9 %) and this association was statistically not significant (Table 7).[17]

Patients who were Muslim/others (63.4 %) were found to be adherent as compared to the patients who were Hindu (58.6 %). This difference was statistically not significant (Table 8).[18]

Adherence was higher among patients who were better educated (up to intermediate and above, 74.4%) as compared to patients educated up to high school or were illiterate (56.5%) and this association was found to be statistically significant (p = 0.035) (Table 9). A study done in Mumbai, India had a parallel finding.[19]

The patients who were unemployed (66.3%) were observed to be adherent in comparison with patients who are employed (56.4%). This association was statistically not significant (Table 10).[7]

It was observed that patients with family size of >4 members, 69.8% were adherent as compared to 52.6% patients with smaller family size of 0–4 members who were adherent (Tables 11 and 12) and this association was found to be statistically significant (p = 0.018).[7]

Level of adherence was higher among patients belonging to upper middle class as compared to patients belonging to lower socioeconomic classes (Table 13). This association was found to be statistically not significant.[20]

Table 12
Total number of family members and Adherence status.

Adherence status	Total number of family members		p value
	Median	IQR [25th percentile-75th percentile]	
Adherent	5	4–6	0.009 (Sig)
Non- adherent	4	3–5	

Mann Whitney *U* test, z = 2.601, p = 0.009 (Sig).

Table 13
Socioeconomic status and Adherence status.

Socioeconomic status	Adherence status		Total
	Adherent	Non- adherent	
Lower and upper lower	64 (56.6)	49 (43.4)	113
Lower middle	36 (66.7)	18 (33.3)	54
Upper middle	10 (71.4)	04 (28.6)	14
Total	110 (60.8)	71 (39.2)	181 (100)

Note: Figures in parenthesis in the table indicate row-wise percentages.
Pearson $\chi^2 = 2.264$, df = 2, p = 0.322 (NS).

Table 14
Tobacco chewing and Adherence status.

Tobacco chewing	Adherence status		Total
	Adherent	Non- adherent	
Current	82 (64.6)	45 (35.4)	127
Past	21 (53.8)	18 (46.2)	39
Never	07 (46.7)	08 (53.3)	15
Total	110 (60.8)	71 (39.2)	181 (100)

Note: Figures in parenthesis in the table indicate row-wise percentages.
Pearson $\chi^2 = 2.803$, df = 2, p = 0.246 (NS).

Table 15
Smoking and Adherence status.

Smoking	Adherence status		Total
	Adherent	Non- adherent	
Current	74 (67.3)	36 (32.7)	110
Past/Never	36 (50.7)	35 (49.3)	71
Total	110 (60.8)	71 (39.2)	181 (100)

Note: Figures in parenthesis in the table indicate row-wise percentages.
Pearson $\chi^2 = 4.96$, df = 1, p = 0.025 (Sig) OR (95% CI) = 2 (1.08–3.69).

Among adherent group patients, 64.6 % of patients currently had habit of tobacco chewing, 53.8 % were past chewers and 46.7 % patients never had this habit (Table 14). This could be attributed to the fact that patients who currently have the habit of tobacco consumption are linked to tobacco cessation services and thus frequent counseling sessions in these patients lead to them being adherent to treatment. But the association of habit of tobacco chewing with adherence was found to be statistically not significant.[18]

Majority (67.3%) patients who currently smoke were found to be adherent as compared to those who used to smoke or the ones who never smoked (50.7%) (Table 15). This could be attributed to the fact that patients who currently have the habit of smoking are linked to tobacco cessation services and thus frequent counseling sessions in these patients lead to them being adherent to treatment. This association was found to be statistically significant (p = 0.025).[18]

As seen in Table 16, majority (65.2%) patients who currently consume alcohol were found to be adherent as compared to those who consumed alcohol in the past or those who never did (53.6%). This could be attributed to the fact that patients who currently have the habit of tobacco consumption are linked to deaddiction services and thus

Table 16
Alcohol consumption and Adherence status.

Alcohol consumption	Adherence status		Total
	Adherent	Non- adherent	
Current	73 (65.2)	39 (34.8)	112
Past/Never	37 (53.6)	32 (46.4)	69
Total	110 (60.8)	71 (39.2)	181 (100)

Note: Figures in parenthesis in the table indicate row-wise percentages.
Pearson $\chi^2 = 2.391$, df = 1, p = 0.122 (NS) OR (95% CI) = 1.62 (0.88–2.99).

Table 17
Family history of TB and Adherence status.

Family history of TB	Adherence status		Total
	Adherent	Non- adherent	
Yes	24 (96)	01 (4)	25
No	86 (55.1)	70 (44.9)	156
Total	110 (60.8)	71 (39.2)	181 (100)

Note: Figures in parenthesis in the table indicate row-wise percentages.
Pearson $\chi^2 = 15.098$, df = 1, p = 0.0001 (Sig) OR (95% CI) = 0.05 (0.01–0.39).

Table 18
Sputum conversion at end of IP and Adherence status.

Sputum AFB grade at end of IP	Adherence status		Total
	Adherent	Non- adherent	
Negative	110 (62.9)	65 (37.1)	175
Positive/Unknown	0 (0)	06 (100)	06
Total	110 (60.8)	71 (39.2)	181 (100)

Note: Figures in parenthesis in the table indicate row-wise percentages.
Fischer's exact test (2 tailed), p = 0.003 (Sig).

Table 19
Sputum conversion at end of CP and Adherence status.

Sputum conversion at end of CP	Adherence status		Total
	Adherent	Non- adherent	
Negative	96 (73.9)	34 (26.1)	130
Positive/Unknown	14 (27.5)	37 (72.5)	51
Total	110 (60.8)	71 (39.2)	181 (100)

Note: Figures in parenthesis in the table indicate row-wise percentages.
Pearson χ^2 = 33.074, df = 1, p < 0.00001 (Sig) OR (95% CI) = 7.462 (3.6–15.46).

frequent counseling sessions in these patients lead to them being adherent to treatment. This association was found to be statistically not significant.[18]

Table 17 shows that most (96%) of the patients who had a family history of TB were found to be adherent as compared to those who didn't have a family history of TB (55.1%) and this association was found to be statistically very highly significant (p = 0.0001). This finding is supported by other study too.[21]

It was observed that 6 (8.5%) out of 71 non-adherent patients had positive/unknown sputum AFB grading at the end of IP since half of them were lost to follow up and the rest turned out to be treatment failure (Table 18). On the other hand, all patients who were treatment adherent (100%) turned out to be smear negative on sputum smear examination at the end of IP. This association was statistically significant (p = 0.003) as also seen in other studies.[22,23]

Majority of patients who were adherent (73.9%) to treatment had successful sputum conversion to negative at the end of CP (Table 19). This association was statistically very highly significant. (p < 0.0001) as observed in other studies too.[24,25]

The various reasons for non-adherence among non-adherent patients are shown in Fig. 1. Among non-adherent group, there were a greater proportion (100%) of patients who reported feeling better/obligations as the main reason for non-adherence as compared to those who did not (11.3%) (Table 20). This association was found to be statistically very highly significant. (p < 0.0001) akin to findings of other studies.[7,26,20,19]

Among non-adherent group, there were a greater proportion of patients who reported forgetfulness as the main reason for non-adherence as compared to those who did not (36.1%) (Table 21) and this association was statistically significant (p = 0.0002) in line with other studies' findings.[26,19]

Table 20
Felt better/Obligations at workplace/home and Adherence status.

Felt better/Obligations at work place/ home	Adherence status		Total
	Adherent	Non-adherent	
Yes	0 (0)	47 (100)	47
No	110 (88.7)	24 (11.3)	134
Total	110 (60.8)	71 (39.2)	181 (100)

Note: Figures in parenthesis in the table indicate row-wise percentages.
Fischer's exact test (2 tailed), p < 0.00001 (Sig).

Table 21
Forgetfulness and Adherence status.

Forgetfulness	Adherence status		Total
	Adherent	Non- adherent	
Yes	0 (0)	09 (100)	09
No	110 (63.9)	62 (36.1)	172
Total	110 (60.8)	71 (39.2)	181 (100)

Note: Figures in parenthesis in the table indicate row-wise percentages.
Fischer's exact test (2 tailed), p = 0.0002 (Sig).

Table 22
Adverse drug reactions during treatment and Adherence status.

Adverse drug reactions during treatment	Adherence status		Total
	Adherent	Non-adherent	
Yes	46 (52.9)	41 (47.1)	87
No	64 (68.1)	30 (31.9)	94
Total	110 (60.8)	71 (39.2)	181 (100)

Note: Figures in parenthesis in the table indicate row-wise percentages.
Pearson $\chi^2 = 4.385$, df = 1, p = 0.036 (Sig) OR (95% CI) = 0.53 (0.29–0.96).

52.9% of patients who were adherent to treatment experienced adverse drug reactions whereas 47.1% of non-adherent patients experienced them (Table 22). This association was statistically significant (p = 0.036) akin to findings of other studies.[20,27]

To examine the relationship of each variable independently with the adherence status and to rule out the effects of confounding and interaction, mathematical modeling was performed (Fig. 2, Table 23).

Borderline non-significant variable entered in regression model was address (duration of residence) with OR = 0.17; 95% CI = 0.04–0.77; p = 0.01.

Predictors of adherence included family history of TB (p = 0.013) and sputum conversion at end of CP (p < 0.001). These variables are

Table 23
Logistic regression.

Sr. no.	Variables	OR	95% CI	p value
1	Age of patients	–	–	0.013
2	Gender of patients	0.58	0.31–1.1	0.096
3	Education	0.45	0.21–0.96	0.035
4	Family size (total family members)	0.481	0.261–0.887	0.018
5	Smoking	2	1.08–3.69	0.025
6	Family history of TB	0.05	0.01–0.39	0.0001
7	Sputum conversion at end of IP	–	–	0.003
8	Sputum conversion at end of CP	7.462	3.6–15.46	<0.0001
9	Felt better (reason for non-adherence)	–	–	<0.0001
10	Obligations at work place/home (reason for non-adherence)	–	–	<0.0001
11	Forgetfulness (reason for non-adherence)	–	–	0.0002
12	ADR during treatment	0.53	0.29–0.96	0.036

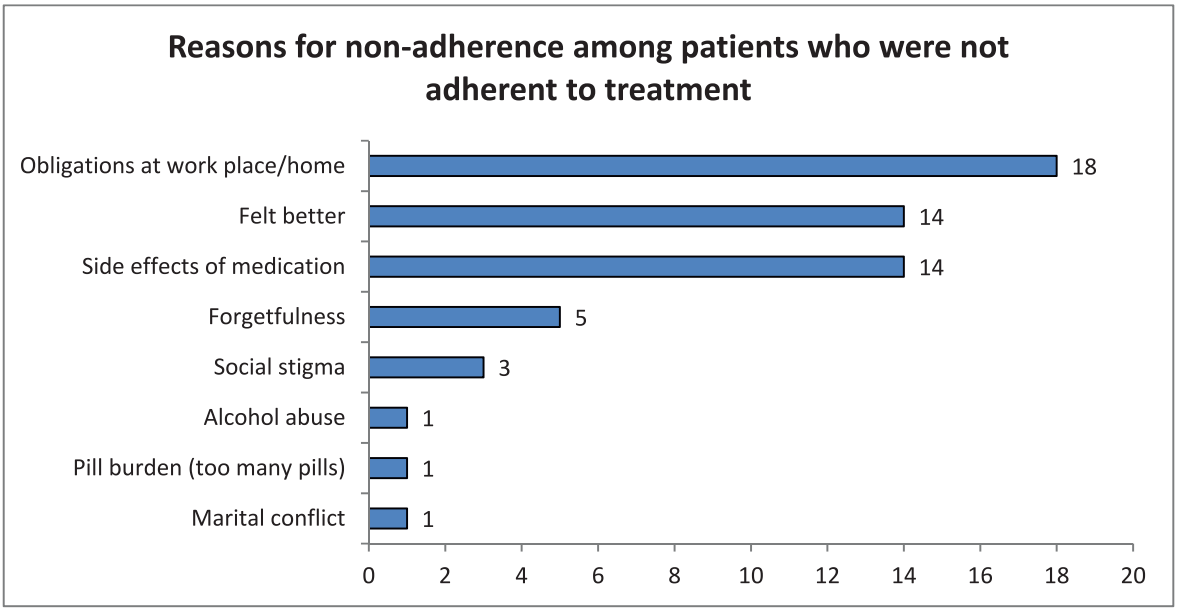

Fig. 1. Reasons for non-adherence among patients who were non-adherent to treatment.

independent risk factors among PTB patients who are non-adherent to treatment.

6. Limitations of study

The current study was a survey follow up study conducted at DOT centre of a tertiary care hospital with a sample size of 181. Generalizability of the study findings could be a concern. A multi-centric study, with patients recruited from all over India, would address this concern.

A survey follow-up study design for a period of six months was chosen, as the primary objective was to study the effect of various socio-demographic factors like level of education, socio-economic status etc on the adherence to the daily regimen For stringent monitoring and long term evaluation of risk factors with inclusion of previously treated PTB patients, a multi-centric cohort study with a follow up period of several years, is necessary.

Our participant group is predominantly urban, relatively less educated and from lower socioeconomic class. Therefore, our results do not necessarily reflect practices in other settings and may limit the generalizability of our findings.

All data on education, living and employment conditions, history of smoking, tobacco chewing, use of alcohol, adverse drug reactions, reasons for non-adherence were reported by patients participating in the study and authenticity could not be ascertained.

The study mainly focused on socio-demographic factors of the patients, thus health care system related factors/treatment provider

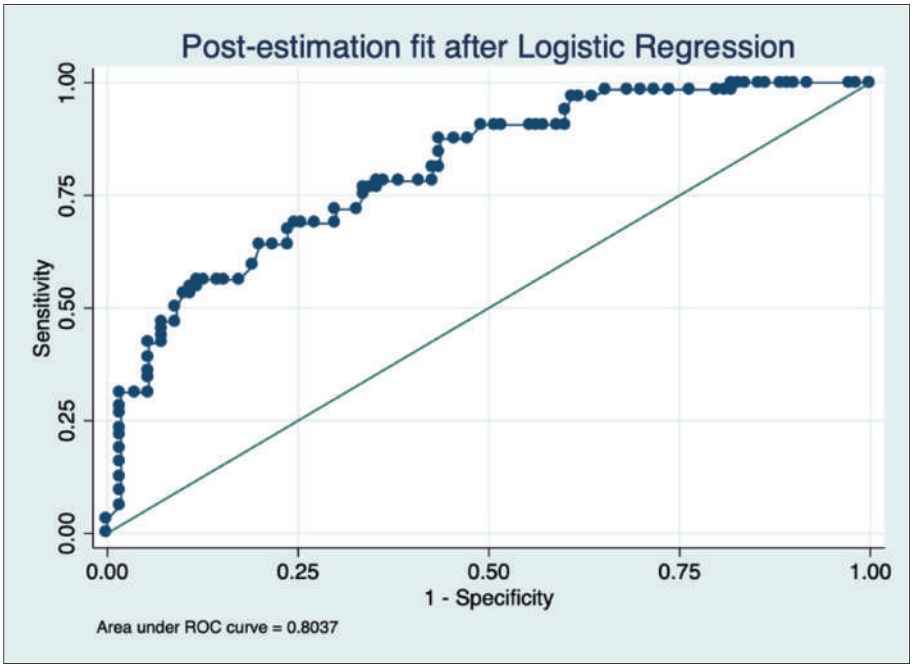

Fig. 2. Receiver Operating Characteristic Curve
The area under curve = 0.8037; Hosmer-Lemeshow test p = 0.6973.

related factors were not taken into account in this study. Also the economic aspects of TB like out of pocket expenditure on part of patients were not taken into account.

7. Conclusions & recommendations

Ensuring robust availability of DBT; intensive tobacco cessation sessions; uniform accessibility to devices like MERM (Medication Event Reminder Monitor) boxes for all diagnosed patients as well as strengthening system for making prophylaxis available for household & close contacts of patients can help in reducing impact of socio-demographic factors & improving adherence levels.

In-patient care might be an alternative, especially during the initial phase of treatment, for a small number of patients for whom other means of ensuring treatment adherence and support are not available.

Dietary counseling & counseling regarding lifestyle modifications can be provided especially in case of TB patients who are severely malnourished since these patients are more likely to become non-adherent to treatment due to side effects of medication and thus have unfavorable treatment outcome.

Patients whose sputum conversion does not occur by the end of IP can be monitored closely to ensure their adherence to the treatment by means of other adherence technologies like facility-based DOT (Directly Observed Treatment) or VOT (Video observed therapy), wherever possible.

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Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Epidemiological determinants and quality of life in PLHIV patients with tuberculosis in Bihar State, India

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ABSTRACT

Background: This study aimed to determine the prevalence of TB among patients living with HIV in Patna district, India. It also assessed the factors contributing to co-infection and evaluated patients' quality of life.
Methods: This cross-sectional study was conducted at the Antiretroviral Therapy (ART) Centre in Patna, India, for a period of eight months. The socio-demographic information was collected through a pre-defined semi-structured questionnaire administered by the interviewer during face-to-face interviews at the time of enrolment. Clinical details were obtained from the hospital records. The statistical analysis was performed using SPSS software.
Results: The study showed that out of 289 people living with HIV, 31% had TB as a co-infection. Male patients had a higher probability of contracting HIV-TB co-infection compared to female patients. The study indicated that advanced WHO staging, male gender, past history of TB, and opportunistic infections were strong predictors. Conversely, the odds of HIV-TB co-infection reduced with a CD4 count of over 300 cells/mm3. However, an increase in age, lower socio-economic status, BMI below the normal range, and presence of comorbidities might increase the odds of HIV-TB co-infection but were not statistically significant. The QoL of HIV-TB patients was significantly lower than that of HIV-only patients.
Conclusions: People with low $CD4^+$ T cell count are at a higher risk of developing TB due to HIV/TB co-infection. The baseline clinical staging of HIV is significantly correlated with TB co-infection. Those in WHO Clinical Stage III and IV have a four times higher risk of developing TB.

1. Introduction

Tuberculosis (TB) and HIV are major health concerns in India, with India having the largest burden of TB and HIV in the world. The primary risk factors for TB infection are malnutrition, HIV infection, alcohol use disorders, smoking, and diabetes. In India, the highest burden of TB and HIV is found in adults aged 15–50 years.[1] Co-infected individuals have a higher incidence and death rate for new AIDS-defining opportunistic infections, which presents immediate and grave public health and socioeconomic threats in developing countries.[2] People living with HIV are 29 times more likely to develop TB disease than those without HIV. The association between HIV and TB is aptly called a 'deadly duo'. The implication of HIV infection is that it activates dormant tuberculosis, leading to increased morbidity and mortality.[3]

Numerous research studies have established that HIV directly causes immunosuppression by depleting host $CD4^+$ T cells. HIV-positive individuals have a higher susceptibility to tuberculosis because of a decrease in their immune cells and lymphocytopenia.[4] $CD4^+$ T lymphocyte levels are the most reliable indicators of a patient's clinical and immunological status.[5] They also help assess the risk of

Abbreviations: HIV, Human immunodeficiency virus; QOL, Quality of life; ART, Antiretroviral therapy; SPSS, Statistical Package for the Social Sciences; BMI, Body mass index; WHO, World Health Organization; HRQOL, Health-Related Quality of Life; HAART, Highly active antiretroviral therapy; 95% CI, Confidence interval at 95 %; aOR, Adjusted odds ratio.

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opportunistic infections like tuberculosis, which is particularly important for individuals with advanced HIV disease. As a result, $CD4^+$ T lymphocyte counts play a crucial role in diagnostic decision-making.[6]

The diagnosis and management of HIV and TB co-infection pose a multifaceted challenge. Diagnostic test efficacy fluctuates across different stages of disease progression, while drug interactions and co-existing conditions can influence dosing, safety, and treatment response. Additionally, immunological reconstitution inflammatory syndrome presents a potential risk, alongside adherence issues. Economic data indicate a higher prevalence of TB among economically active adult males from lower socio-economic backgrounds, potentially impeding economic growth.

The World Health Organization defines Quality of Life (QOL) as an individual's evaluation of their cultural context, values, goals, expectations, standards, and personal concerns in relation to their current life circumstances. Even for those who achieve viral suppression through antiretroviral therapy (ART), the disease and its accompanying consequences remain significantly influence the Health-Related Quality of Life (HRQOL) of those living with HIV, despite the fact that ART has improved survival rates. Many characteristics of HIV-positive individuals, including age, immunological status, symptom presence, medication adherence, depression, social support, and work status, have been found to be systematically correlated with HRQOL.[7] QOL is a primary metric used to measure the health condition of people living with HIV, and therapy aims to improve it.

The purpose of this research was to ascertain the incidence of tuberculosis (TB) in HIV patients undergoing Highly Active Antiretroviral Therapy (HAART) at the Antiretroviral Therapy (ART) clinic located in the Patna district of the Bihar area. Furthermore, we evaluated the clinical and sociodemographic features of HAART-using patients who also had TB and HIV co-infections, and we compared the quality of life of HIV-positive patients at the ART facility with that of patients who had co-infections. The study's findings will be applied to the creation of treatments meant to enhance the quality of life for those who are co-infected with TB and HIV.

2. Methodology

2.1. Study area, design, and period

This cross-sectional study was conducted at the Antiretroviral Therapy (ART) Centre of Indian Council of Medical Research (ICMR)-Rajendra Memorial Research Institute of Medical Sciences (RMRIMS), Agamkuan, Patna, India, with patients who have been receiving ART for a minimum duration of one month. The research project spanned eight months, from September 2023 to April 2024. During the study period, patients were interviewed to collect sociodemographic details, including their medication routines, travel history, smoking and drinking habits, and any symptoms such as fever, night sweats, repeated coughing, sputum, phlegm with cough, breathing discomfort, fatigue, or weakness.

2.2. Inclusion and exclusion criteria

All patients who are 18 years or older, regardless of gender, were included provided that they had signed the informed consent form. Patients who were newly diagnosed with HIV, had not completed one month of antiretroviral drug therapy, or had extra-pulmonary tuberculosis were not considered for the study.

2.3. Sampling procedure

The sample size of 250 was estimated using a prevalence of 20.1 % for bacteriologically confirmed pulmonary (TB)±5, margin of error of 5%, and 95% Confidence interval.

2.4. Study procedure

This study included 289 HIV-positive patients who were previously diagnosed as HIV positive in the ART Center during the study period. The information on socio-demographic characteristics was collected with the help of an interviewer-administered questionnaire at the time of patient registration at the ARTC. The clinical characteristics, i.e., $CD4^+$ count, viral load, diagnosis of TB infection, i.e., CBNAAT, Microscopic technique (i.e. AFB), chest X-ray, and WHO clinical staging of PLHIV, were reviewed from the center records on the further visit by the researcher.

Strict confidentiality was maintained throughout and later. Data were collected through the case record proforma, which included general information of the patients, clinical profiles of PLHIV patients, lab pathological values, measurement of adherence, and screening for tuberculosis.

2.5. Measurements of quality of life

The WHOQOL Questionnaire for HIV Brief Version was used to assess the patients' quality of life (WHOQOL-HIV BREF). This multidimensional, general questionnaire was developed by the World Health Organization and consists of 31 items that are assessed using a five-point Likert scale.[8] There are 31 items in the WHOQOL-HIV BREF, which are categorized into six domains: environment (Q12 + Q13 + Q16 + Q19 + Q28 + Q29 + Q30), spirituality, religion, and personal beliefs (Q7 + Q8 + Q9 + Q10), degree of independence (Q5 + Q22 + Q23 + Q20), physical (Q3 + Q4 + Q14 + Q21), psychological (Q6 + Q11 + Q15 + Q24 + Q31), and social relations (Q27 + Q26 + Q25 + Q17). Out of the 31 questions, 29 domain-specific items were used to assess an individual's quality of life (QOL) in six domains: physical, psychological, level of independence, social interactions, environment, and spirituality. Two domains were used to assess the participants' perceptions of their general quality of life and health.[9] Options 1 and 5, which represent the lowest and greatest values, were offered in the majority of queries.[10] Responses were first scored inversely before being computed, albeit, in situations where a higher score did not necessarily translate into a higher QOL. The entire number of points earned from all of the questions in each domain was added up, divided by the total number of questions, and multiplied by four to determine the score for each domain. The scores for each domain varied from four to twenty, with four represented the worst state and twenty the best. This technique has been proven to be legitimate and reliable, and it is widely used throughout the world, especially in Iran.[10,11]

2.6. Data collection

In the data collection procedure, semi-structured questionnaires were handed out to participants, and the questionnaires were accessible to address any confusion that may have arisen. The information was gathered using a self-administered questionnaire; however, the interviewer administered it to illiterate individuals. The individuals received an option regarding their literacy status. To ensure patients' privacy, data collection was undertaken in the clinic's counseling rooms using a questionnaire and an interview. Participants were promised that whether or not they participated in the study, the services they received would remain the same.

2.7. Exposure variables

The exposure variable was age in completed years, sex (male or female), marital status, the residence of the patients broadly such as urban, semi-urban, rural, semi-rural, and mobile, highest education attained occupation, and socio-economic status (using Modified Kuppuswamy scale version) of the family of the participants and calculated. We have also noted social habits such as smoking cigarettes and drinking

alcohol. The patients show various symptoms such as fever, chills, night sweats, muscle aches, swollen lymph nodes, mouth ulcers, and others that were also noted during the collection of the data.[12] The body mass index (BMI) (kg/m2) was determined and classified using the WHO Asian BMI classification. CD4 cell count was taken from hospital records and was categorized as <300 cells/L and >300 cells/L. Also, the viral load ranges from <20 copies per ml to more than >75 copies per ml. The WHO clinical staging was followed.[13,14] For the study, the stages were clubbed based on the activity of the individual: WHO Stage I and II: ambulatory patients, whether asymptomatic or symptomatic. WHO Stage III and IV: bedridden for any number of days in the past month.

2.8. Ethical approval

Ethical clearance for the study was obtained from the Institutional Review Board of Rajendra Memorial Research Institute of Medical Sciences (RMRI), Agamkuan, Patna, research and teaching public health institute, under ethical letter number RMRI/EC/30/2023. The study's purpose was clearly explained to the patients, and written informed consent was obtained from each participant. Furthermore, all information collected from the participants was kept confidential throughout the study period.

2.9. Statistical analysis

IBM SPSS Statistics for Windows, Version 28.0 (IBM Corp, Armonk, NY), was utilized for the statistical analysis. Data entry was initially done using Microsoft Excel. Both descriptive and inferential analyses were carried out. Descriptive statistics are presented as frequencies and percentages. To compare proportions, the Chi-square test (or Fisher exact test) was employed. A *P*-value of less than 0.05 was considered statistically significant, with a 95% confidence level. Multivariate logistic regression was conducted to predict HIV-TB co-infection (dependent variable), using variables that were found to be statistically significant in the bivariate analysis as predictors (independent variables). Adjusted odds ratios (aOR) are reported with 95% confidence intervals (CI) to provide insight into the strength of associations.

3. Results

3.1. Summary of demographic of participants

This study involved a total of n = 300 patients who were PLHIV-positive and visited the institute's ART Centre. Out of these, 289 patients were eligible for the study as they fulfilled the inclusion criteria of being 18 years or above and having taken HAART therapy for more than one month. TB testing was carried out for all eligible patients, and the results revealed that 88 patients (31%) were TB positive, as shown in Fig. 1. The epidemiological factors that influence HIV and co-infection are presented in (Table 1). The statistically significant p-values are highlighted in bold.

The mean (standard deviation [SD]) age of the study participants was 36.65 (10.26) years. Among the participants in the study, 193 (66.78%) were male and 96 (33.21%) were female. Most participants (83.73%) were married, whereas 16.26% were single, divorced/widowed, or living apart from their partner. Socio-economically, 32 (33.00%) belonged to the lower middle class, 21 (25.60%) to the lower class, 19 (26.00%) to the upper lower class, followed by 16 (42.10%) to the upper middle class, and none to the upper class, according to the modified Kuppuswamy scale categorization. Among the total participants, 86.15% were literate. Occupation profiles of the participants with HIV/TB co-infection revealed that 41.90% were farmers, 37.80% were daily labourer's, 34.20% were merchants, 23.20% were housewives, followed by government employees (30.80%). In contrast, the jobless and students were 10.00% and 20.00%, respectively.

3.2. Clinical characteristics

The distribution of clinical determinants of HIV-TB cases is shown in (Table 2). The mean (SD) BMI of the study participants was 21.43 (8.33). In our study, the majority (68.40%) of the participants who had HIV only were of normal weight, while among HIV-TB co-infection cases, 31.60% were normal weight. Only 25.00% were underweight, and 18.20% were obese among HIV-TB co-infected patients. BMI had a statistically significant correlation with HIV-TB co-infection ($p < 0.001$). A past history of tuberculosis was also found to have a significant correlation with HIV-TB co-infection. 80.20% of individuals with HIV-TB had a history of TB positivity. Comorbidities had no direct correlation with HIV-TB participants.

3.3. Clinical determinants

Clinical staging of HIV also had a statistically significant correlation with HIV-TB co-infection ($p < 0.001$). 85.70% of HIV-TB co-infected individuals were in Stage IV, and 14.30% of HIV-positive alone. The majority (89.60%) of HIV-positive patients were in the early stage against only 10.40% of HIV-TB co-infected.

The results of this study demonstrated that in comparison to HIV infection, low CD4 count (<100/mcl) had a statistically correlation with HIV/TB co-infection. Any stage of $CD4^+$ T cell count decline can lead to

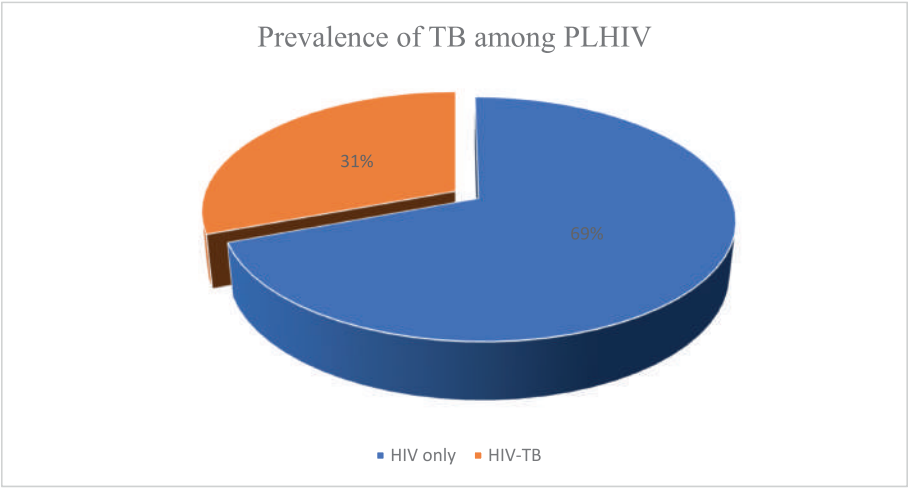

Fig. 1. Prevalence of tuberculosis among PLHIV.

Table 1
Epidemiological determinants of HIV-TB co-infection.

Characteristics		HIV only (n = 201)		HIV-TB (n = 88)		df, X^2, *p*-value
		Count	Row N %	Count	Row N %	
Age (in years)	18–30	71	72.40%	27	27.60%	3,0.71,0.87
	31–40	66	68.00%	31	32.00%	
	41–50	47	69.10%	21	30.90%	
	>50	17	65.40%	9	34.60%	
Gender	Female	75	78.10%	21	21.90%	1,4.99,0.025
	Male	126	65.30%	67	34.70%	
Residence	Mobile	21	72.40%	8	27.60%	5,3.07,0.689
	Semi-rural	54	70.10%	23	29.90%	
	Rural	98	70.00%	42	30.00%	
	Semi-Urban	25	61.50%	15	38.50%	
	Urban	3	100.00%	0	0.00%	
Education status	Uneducated	25	62.50%	15	37.50%	3,1.28,0.734
	Primary school	50	69.40%	22	30.60%	
	Secondary school	48	72.70%	18	27.30%	
	Tertiary school	78	70.30%	33	29.70%	
Occupation	Daily labour	28	62.20%	17	37.80%	8,10.21,0.25
	Farmer	25	58.10%	18	41.90%	
	Freelancer	5	80.00%	1	20.00%	
	Government employee	9	69.20%	4	30.80%	
	Housewife	53	76.80%	16	23.20%	
	Jobless	9	90.00%	1	10.00%	
	Merchant	48	65.80%	25	34.20%	
	Student	24	80.00%	6	20.00%	
Income (INR)	<300000	103	74.63%	35	25.37%	3,3.67,0.299
	300000–500000	87	65.40%	46	34.60%	
	500000–750000	11	61.10%	7	38.90%	
Socio-economic status	Lower	61	74.40%	21	25.60%	5,7.02,0.219
	Lower Middle	63	67.00%	32	33.00%	
	Upper lower	54	74.00%	19	26.00%	
	Upper middle	22	57.90%	16	42.10%	
	Upper	1	100.00%	0	0.00%	
Marital status	Single	21	75.00%	7	25.00%	3,0.67,0.881
	Married	167	69.00%	75	31.00%	
	Divorced	3	60.00%	2	40.00%	
	Widowed	10	71.40%	4	28.60%	
Family size	≤3	10	90.90%	2	9.10%	3,6.62,0.085
	3–4	144	71.30%	58	28.70%	
	>5	47	62.70%	28	37.30%	
Alcohol intake	Never	152	80.40%	37	19.60%	3,56.32, <0.001
	Often	45	64.30%	26	35.70%	
	Regular	4	13.80%	25	86.20%	
Smoking	Never	154	81.50%	35	18.50%	2,91.03, <0.001
	Often	37	86.00%	6	14.00%	
	Regular	10	17.50%	47	82.50%	

TB. Compared to 58.60% of cases with HIV positive, and 41.40% of people with HIV/TB co-infection had a CD4 count of less than 300 cells/mm^3 ($X^2 = 1.818$, df = 1, $p = 0.178$).

After the multivariate analysis, binary logistic regression was used to find the relationship among independent variables (age, gender, socio-economic status, BMI, WHO staging, CD4 count, past h/o of TB, comorbidities and past h/o of opportunist infections) found to be associated with HIV-TB on bivariate analysis, for the predicting co-infection among PLHIV. Using backward variable selection methods, a multivariate logistic regression model found four covariates. Gender, WHO-staging, past h/o of TB and past h/o of opportunistic infections of individual to be predictors of HIV-TB co-infection (Table 3).

Among these exposure variables, WHO-staging (aOR = 20.92 [9.592–42.36]; P= <0.0001), Gender (aOR = 1.899 [1.097–3.286]; $P = 0.025$), past h/o TB (aOR = 32.68 [16.37–66.00]; P= <0.001), past h/o opportunist infections (aOR = 4.829 [1.252–17.85]; $P = 0.016$). On contrary CD4 count more than 300 may be a factor a decrease the odds of HIV-TB co-infection (aOR = 0.58 [0.265–1.301]; P = 0.177). Also increase in age (aOR = 1.233 [0.501–2.754]; $P = 0.628$), lower socio-economic status (aOR = 1.063 (0.626–1.764); P = 0.897).

3.4. Health-related quality of life

Mean and standard deviation of QOL of HIV and HIV-TB patients' QOL domains are mentioned in (Table 4). The mean values of psychological (10.53 v/s 8.71; $p < 0.001$), level of independence (9.29 v/s 8.26; $p < 0.001$), social relation (10.01 v/s 9.42; $p = 0.003$), environmental (10.24 v/s 9.15; $p < 0.001$), Spiritual/religious/personal beliefs (10.53 v/s 8.71; $p < 0.001$) and overall QOL (60.99 v/s 56.08; $p < 0.001$) was found to be significantly lower in HIV-TB patients as compare to HIV only patients, which clearly makes a remark that QOL found poorer in HIV-TB patients. Physical (10.92 v/s 11.24; $p < 0.066$) was not found significant.

4. Discussion

In the 289 HIV-positive patients in our study who visited the ART Clinic and received treatment, 88 (31%) of them also had TB infection in addition to HIV, and the remaining 201 (69%) were HIV positive only. Comparably, Gupta et al.'s study, which involved 251 HIV-positive patients at a tertiary care teaching public health institute in North India, discovered that 69 (27.5%) of the patients had co-infection with HIV and TB, whereas the remaining 182 (72.5%) were HIV-positive solely.[15] An additional investigation by Padyana et al. of 200 HIV + patients at a

Table 2
Clinical determinants of HIV-TB co-infection.

Characteristics		HIV only		HIV-TB		df, χ^2, *p*-value
		Count	Row N %	Count	Row N %	
WHO staging	Stage I	121	89.60%	14	10.40%	3,97.09, <0.001
	Stage II	70	71.40%	28	28.60%	
	Stage III	5	23.80%	16	76.20%	
	Stage IV	5	14.30%	30	85.70%	
Comorbidities (if any)	No	174	71.60%	69	28.40%	1,3.04,0.081
	Yes	27	58.70%	19	41.30%	
BMI	Underweight	21	75.00%	7	25.00%	2,1.33,0.514
	Normal	171	68.40%	79	31.60%	
	Overweight	9	81.80%	2	18.20%	
Past h/o TB	No	185	88.90%	23	11.10%	2131.84, <0.001
	Yes	16	19.80%	65	80.20%	
Past h/o any opportunistic infections	No	198	70.60%	82	29.40%	2,6.16,0.05
	Yes	3	33.30%	6	66.70%	
Mode of transmission	Heterosexual	52	68.40%	25	31.60%	9,16.21,0.063
	Mother to child	14	93.30%	1	6.70%	
	MSM	25	69.40%	11	30.60%	
	Needle/Syringes	25	73.50%	9	26.50%	
	Other drug injection equipment	4	66.70%	2	33.30%	
	Others	5	55.60%	4	44.40%	
	Sexual	56	62.20%	34	37.80%	
	Unknown	19	95.00%	1	5.00%	
	Vaginal sex	1	50.00%	1	50.00%	
CD4 Count	<300	17	58.60%	12	41.40%	1,1.89,0.178
	>300	184	70.80%	76	29.20%	

Table 3
Regression analysis examining factors associated with HIV.

Characteristics	aOR (95% CI)	p-value
Age	1.233 (0.501–2.754)	0.628
Gender	1.899 (1.097–3.286)	0.025
Socio-economic status	1.063 (0.626–1.764)	0.897
BMI	1.350 (0.5507–3.540)	0.509
WHO Staging	20.92 (9.592–42.36)	<0.0001
CD4 Count	0.58 (0.265–1.301)	0.177
Past h/o TB	32.68 (16.37–66.00)	<0.001
Comorbidities	1.775 (0.935–3.389)	0.081
Past h/o opportunistic Infection	4.829 (1.252–17.85)	0.016

Table 4
Results of mean and standard deviation of QOL of HIV and HIV-TB patients.

QOL domains	HIV only (n = 194)		HIV-TB (n = 95)		p-value
Physical	10.92	1.36	11.24	1.43	0.066
Psychological	10.53	1.43	8.71	1.89	<0.001
Level of independence	9.29	1.40	8.26	1.76	<0.001
Social relations	10.01	1.43	9.42	1.76	0.003
Environmental	10.01	1.14	9.30	1.20	<0.001
Spiritual/religious/personal beliefs	10.24	1.53	9.15	1.98	<0.001
Overall	60.99	4.45	56.08	6.43	<0.001

South Indian tertiary care hospital revealed that 146 (73%) of the patients were HIV positive alone, while 54 (27%) had co-infection with tuberculosis.[16]

Male individuals under 40 years of age and living in rural areas who work as daily laborers have a greater chance of contracting HIV-TB co-infection. Our analysis has shown that gender, alcohol intake, and smoking are significant factors in co-infection. These socio-demographic findings are comparable to those from similar studies in other countries, such as Gupta et al. and Giri et al. in India, Due to variations in social behaviour, stigma, and discrimination that prevent reporting of cases and limited access to public healthcare in many parts of the world, females typically have a lower rate of co-infection. However, studies by Melkamu et al. have found that females are more susceptible to developing HIV-TB co-infection.[17] BMI below normal range (aOR = 1.350 [0.5507–3.540]; $p = 0.509$), and presence of comorbidities (aOR = 1.775 [0.935–3.389]; P = 0.081) might be a possible factor to increase the odds of HIV-TB co-infection. In our study; these factors had found no statistically significant association with HIV-TB.

The immune status of patients having a CD4 level <300 cells/mm^3, were identified as a risk factors for TB development among HIV patients. But some researchers also believes that if patients are ongoing treatment on ART so they improve the CD4 count as a study done by Netanya et al. In our findings, the patients were on regular treatment of ART and they were adhered to their drugs which results them a better CD4 count.[18]

Our study showed that QOL in PLHIV was better as compared to those with HIV-TB. The reason of being better QOL among PLHIV patients might be due to the proper medication adherence towards antiretroviral therapy as compared to patients with HIV-TB where polypharmacy might be the driving factor for poor medication adherence eventually leading to poor QOL.[19] Patients diagnosed with HIV-TB were linked to a weakened immune system, poor physical and social functioning, and worsening symptoms when their activities increased. Low mean scores on tests of physical, psychological, and degree of independence, according to a study, suggested a lack of social and institutional support.[9] However, the results, which matched those from India, demonstrated that among the domains, spirituality, religion, and personal beliefs received the highest scores. Previous studies have shown that psychological and social factors interact in a complex way, affecting individuals' physical, mental, and social circumstances as well as their quality of life (QOL), both directly and indirectly.[20]

Our research revealed an important link between the baseline clinical staging of HIV and TB co-infection.[21] When compared to those in the WHO Clinical Stage I and II, those in the WHO Clinical Stage III and IV had a roughly four-fold increased risk of developing TB. Both Melkamu et al. and Taha et al. have reported similar findings.[17,22] This could be explained by the fact that the immune system's ability to fend off infection would decline as HIV advances, increasing the risk of tuberculosis. The fact that TB is one of the AIDS defining factors used to place patients into the late WHO clinical staging group lends more credence to the conclusion.

4.1. Strength of study

The study addresses a critical health issue by focusing on HIV and TB co-infection, which has a substantial impact on mortality among vulnerable populations. The study assesses sociodemographic and clinical factors contributing to HIV-TB co-infection, offering a holistic understanding of the disease dynamics. By comparing the QOL of patients with HIV-TB co-infection to HIV-only patients, it highlights the broader impact of co-infection on patient well-being.

4.2. Limitations of the study

The linked epidemiological determinants must be investigated in a bigger sample because the study was constrained to a facility-based setting over a limited time period, thus a small sample size.

5. Conclusion

The research study showed that among newly and previously diagnosed HIV-infected adults receiving care and treatment at an ARTC, TB was found to be prevalent among a considerable proportion, much higher than the state and national average. Compared to those suffering from HIV infection alone, co-infected individuals were undernourished and had significantly lower CD4 count and higher clinical staging of HIV, demonstrating a poor prognosis as well as poor QOL of HIV-TB patients.

Data availability statement

Data will be made available on request.

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Intellectual property

We confirm that we have given due consideration to the protection of intellectual property associated with this work and that there are no impediments to publication, including the timing of publication, with respect to intellectual property. In so doing we confirm that we have followed the regulations of our institutions concerning intellectual property.

Dual publication statement

We wish to confirm that the work described in this manuscript has not been published previously and is not under consideration for publication elsewhere. It is also to confirm that this is the author's original work.

All authors have seen and approved the final, submitted version of this manuscript.

Declaration of competing interest

We wish to confirm that there are no known conflicts of interest associated with this publication and there has been no significant financial support for this work that could have influenced its outcome.

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Depression symptoms among Afghan TB patients: A multi-center study

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ABSTRACT

Background: Depression in TB patients carries a heightened risk of treatment failure and a lower quality of life. However, no study to date has documented depression prevalence among TB patients in Afghanistan.
Objectives: We aimed to assess depression prevalence in TB patients in Southern Afghanistan.
Methods: Between February 2023 and May 2024, a sample of 1,003 TB patients aged 18 years and above were randomly sampled in Southern Afghanistan. The questionnaire gathered patients' sociodemographic information, clinical characteristics, social support level, and the PHQ-9 (Patient Health Questionnaire). We fitted a binary logistic regression model to identify correlates of depression symptoms among TB patients.
Results: Out of 1,003 patients, 69.6% (95% CI: 66.6%-72.4) had depression symptoms. We found that patients with no formal education [AOR = 3.18, 95%CI (2.35–4.30)], those with severe disease [1.84 (1.30–2.59)], patients with medical comorbidity [1.88 (1.29–2.74)], and those with low social support [1.69 (1.22–2.33)] were more likely to have depression symptoms.
Conclusion: TB patients in Afghanistan have high levels of depressive symptoms. Therefore, this study advocates for dedicated mental health screening and counseling services for TB patients in Afghanistan.

1. Introduction

Tuberculosis (TB) remains one of the pressing global health concerns.[1] In 2022, about 1.3 million people died from TB, with 80% of these deaths occurring in low and middle-income countries (LMICs) where weak or unprepared healthcare systems are unable to offer comprehensive services for this disease.[2] In Afghanistan, TB care faces challenges due to the country's history of conflict and persistent socio-economic instability.[3,4] Mental health symptoms also remain prevalent, adding complexity to the fight against TB challenges in the country.[3,5]

TB has been consistently associated with mental health symptoms, including depression.[6,7] Evidence suggests that depression among TB patients is associated with worse treatment outcomes and lower quality of life.[8,9] There is also evidence of low adherence to TB treatment in comorbid depressed patients.[4] This not only underscores the immediate need for improved access to mental health services but also emphasizes the importance of addressing the underlying determinants influencing depression symptoms in TB patients, especially in regions like Afghanistan.

Several studies have examined depressive symptoms among TB patients in LMICs.[10,11] For instance, Duko Bereket et al. conducted a systematic review of 25 studies and showed that the pooled prevalence of TB-related depression was 45.1%.[11] Similarly, Alemu et al. observed a comparable prevalence (43.03%) in their systematic review of studies in East Africa.[12] The reported prevalence of depression was 57.8% in India,[13] 55.9% in Ethiopia,[10] and 35% in Pakistan.[14] However, no study has reported on depression comorbid with TB in Afghanistan. Such information is crucial to developing strategies for comprehensive TB care in the country.

A growing body of literature investigated the significant influence of several factors on the prevalence of depressive symptoms in TB patients. A meta-analysis conducted by Amha et al. found that the presence of comorbidity, being in the intensive phase of treatment, and drug-resistant diagnosis were associated with depressive symptoms in Sub-Saharan Africa.[15] In addition to this, female gender, low monthly

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income, perceived stigma, longer illness duration, single marital status, residence, HIV co-infection, low educational attainment, unemployment, poverty, and poor social support have been identified as determinants of TB-relate depression across studies in LMICs.[10,13,16–19] Despite these established connections, research in Afghanistan remains sparse, particularly in light of unique societal challenges.[20,21] Understanding the determinants of depressive symptoms among TB patients in Afghanistan has the potential to inform targeted screening and management efforts.

Screening and management for depression among TB patients are recommended by several studies.[14,22,23] For example, mental health interventions in a prospective cohort of 3,500 TB patients in Pakistan reduced depression symptoms and improved treatment outcomes.[24] Similarly, a single-center prospective study in India advocates for routine evaluation of depression symptoms in TB patients.[25] Moreover, depression care is integrated into TB treatment programs in several countries.[6,14,23] However, screening for depression is not routinely carried out in TB treatment programs in Afghanistan.[3,4]

Information on the prevalence and correlates of depression symptoms among TB patients is necessary to provide a baseline for policy efforts and specific interventions aimed at improving TB care in Afghanistan. Therefore, we aimed to assess the prevalence and correlates of depression symptoms among TB patients in Southern Afghanistan.

2. Methods

This is a facility-based cross-sectional that was conducted from February 2023 to May 2024 in Kandahar and Helmand provinces, situated in Southern Afghanistan. Through a purposive sampling approach, two provincial TB centers, two comprehensive health centers (CHCs), one regional hospital, and one teaching hospital were selected from over 50 TB treatment sites across Southern Afghanistan. Briefly, the study encompassed key TB treatment facilities in the South, and findings may hold for the region in general.

All patients aged 18 years or older receiving anti-TB treatment at selected study sites in Southern Afghanistan were involved in the study. Exclusion criteria for all participating centers included a diagnosis of drug-resistant TB. We also excluded non-consenting patients.

The sample size was 1,020 patients, determined by the following formula [$n = Z^2P\ (1-P)/(d)^2$] provided $Z = 1.96$, $P = 0.5$ (maximum estimates), and $d = 0.05$. A 20% non-response rate and a 2.0 design effect were added, resulting in a sample size of 922 patients. To enhance the reliability and variability of the results, we increased the minimum sample size from 922 to 1,020 patients.

The allocation of sample size to each facility was done proportional to the number of TB patients in the particular facility. The total number of patients allocated to Mirwais Regional Hospital was 392, followed by Helmand Provincial TB Center (221), Kandahar Provincial TB Center (148), Nazo Ana CHC (101), Shamsul-Haq CHC (97), and Kandahar Teaching Hospital (61). Within each facility, patients were selected randomly by lottery methods.

Patient self-reports of depression were obtained using the Pashtu version of the PHQ-9 (Patient Health Questionnaire). The PHQ-9 total score ranges from 0 to 27, with a higher score indicating more severe depression.[26] The severity of depression symptoms was evaluated as follows: none (0–4), mild depression (5–9), moderate depression (10–14), severe depression (15–19), and extremely severe depression ($\geq$20).[26] Given the study objective, all depression categories were collapsed into one category, as were any depression symptoms. PHQ-9 is a credible instrument for assessing self-reported depression and is widely used in Afghanistan and elsewhere.[4,27] In the current study, Cronbach's α was 0.92.

The correlates of depression among TB patients we examined included sociodemographic information (sex, age, education level, marital status, residence, monthly income, and employment), clinical characteristics (treatment duration, self-perceived severity, family history of TB, presence of comorbidity, TB knowledge, TB stigma, and history of anti-TB drugs side effects), and social support level.

Social support was measured by the 3-item Oslo Social Support Scale (OSSS-3) and was classified into three categories as previously: low (score, 3–8), intermediate (score, 9–11), and high (score, 12–14).[28] Previous studies in Afghanistan have shown that the scale has good psychometric properties.[4,29] In the current study, the scale had a Cronbach's α of 0.87.

The data were collected by using a structured questionnaire, which contained four sections for capturing sociodemographic details, disease-related characteristics, as well as the PHQ-19 and OSSS-3 sections. The questionnaire underwent a pilot test for clarity and understandability with 50 TB patients in January 2023.

A pair (male/female) of trained data collectors under the direct supervision of the research team at each participating center obtained the data through face-to-face interviews. Prior to the interview, patients were informed about the study's objectives, and informed consent forms were obtained. The study procedures were monitored by the principal investigators and the Ethics Committee.

We performed all statistical analyses using SPSS version 27.0. Descriptive results are presented as numbers and percentages. We used chi-square statistics to determine differences in categorical variables (sociodemographic information, clinical characteristics, and social support levels) among patients with different levels of depression symptoms. A binary logistic regression model was fitted to identify correlates for depression among TB patients, with a significance level set at 5%.

The study protocol and informed consent form were approved by the Research and Ethics Committee for all participating centers. We obtained consent from all participants (either written or oral if unable to read). Moreover, the study was conducted in accordance with local ethical guidelines and in compliance with the Declaration of Helsinki.

3. Results

A total of 1,003 TB patients aged $\geq$18 years participated in this study (response rate = 98.3%). Of those, 526 (52.4%) were female, 538 (53.6%) were rural residents, and 389 (38.8%) were in the age group 26–40 years. Most of the participants were married (77.9%), had no formal education (59.9%), and were not gainfully employed (60.7%). Similarly, 84.6% of patients lived in households with more than 5 members. Most respondents, 530 (52.8%), had a monthly household income that is less than 10,000 Afghanis (details in Table 1).

As indicated in Table 2, 937 (93.4%) patients were newly diagnosed, and 823 (82.1%) had pulmonary TB. Nearly 40% of the patients were on treatment for 1–2 months, and one-fourth experienced (25.6%) anti-TB drug side effects. Moreover, 506 (50.5%) had severe or very severe TB. Almost 20% had a medical comorbidity, 30.8% (309) had TB-related stigma, 10.8% (108) were currently smoking, and 66.6% (668) had low social support (Table 2).

The overall prevalence of depression among TB patients was 69.6% (95%CI: 66.6%-72.4). The prevalence of mild, moderate, severe, and extremely severe depression is shown in Fig. 1.

The multivariable logistic regression showed that patients with no formal education [AOR = 3.18, 95%CI (2.35–4.30)], those with severe disease [1.84 (1.30–2.59)], patients with medical comorbidity [1.88 (1.29–2.74)], and those with low social support [1.69 (1.22–2.33)] were more likely to have depression symptoms (Table 3).

4. Discussion

This study aimed to assess the prevalence and correlates of depressive symptoms among TB patients who were on anti-TB treatment in Southern Afghanistan. We found that more than two-thirds (69.6%) of TB patients had depression symptoms. Findings further indicated that

Table 1
Sociodemographic characteristics of the study participants (n = 1,003).

Characteristics	Frequency (%)
Age (In completed years)	
18-25	259 (25.8)
26-40	389 (38.8)
41-60	271 (27.0)
>60	84 (8.4)
Sex	
Male	477 (47.6)
Female	526 (52.4)
Residence	
Urban	465 (46.4)
Rural	538 (53.6)
Marital status	
Single	184 (18.3)
Married	781 (77.9)
Divorced/Widowed	38 (3.8)
Educational status	
No formal education	601 (59.9)
Religious	173 (17.2)
Primary	121 (12.1)
Secondary	40 (4.0)
High school graduate	63 (6.3)
Higher studies	5 (0.5)
Employment status	
Self-employed	262 (26.1)
Employed (Public/Private)	132 (13.2)
Housewife	302 (30.1)
Unemployed	307 (30.6)
Household members	
≤5	154 (15.4)
>5	849 (84.6)
Monthly household income (In Afghanis)	
<10000	530 (52.8)
10000-20000	327 (32.6)
>20000	146 (14.6)
Displacement/Migration	
Yes	192 (19.1)
No	811 (80.9)

Table 2
Disease-related characteristics of the study participants (n = 1,003).

Characteristics	Frequency (%)
Type of TB patient	
New	937 (93.4)
Relapse	50 (5.0)
Lost to follow-up	16 (1.6)
Type of TB	
Pulmonary TB	823 (82.1)
Extrapulmonary TB	180 (17.9)
Self-perceived disease severity	
Very severe	131 (13.1)
Severe	375 (37.4)
Moderately severe	259 (25.8)
Not very severe	202 (20.1)
Not severe at all	36 (3.6)
Duration of TB treatment (In months)	
1-2	400 (39.9)
3-4	239 (23.8)
5-6	204 (20.3)
>6	160 (16.0)
TB Knowledge	
Yes	502 (50.0)
No	501 (50.0)
Experienced TB drug adverse effects	
Yes	257 (25.6)
No	746 (74.4)
Counseling during treatment	
Yes	737 (73.5)
No	266 (26.5)
Family history of TB	
Yes	107 (10.7)
No	896 (89.3)
TB stigma	
Yes	309 (30.8)
No	694 (69.2)
Comorbidity	
Yes	196 (19.5)
No	807 (80.5)
Currently smoking	
Yes	108 (10.8)
No	895 (89.2)
Social support levels	
Low	668 (66.6)
Intermediate	245 (24.4)
High	90 (9.0)

lower education levels, severe disease, presence of medical comorbidity, and poor social support were associated with depression symptoms in TB patients.

Depression among TB patients is of particular importance to public health officials in many countries due to its association with increased risk of adverse health outcomes.[6,8,9,22,24] The study revealed a high prevalence (69.9%) of depression symptoms in the study population. The prevalence of depression symptoms in our study was higher than the findings reported in most previous studies conducted in LMICs.[11,12,15,17,18,25] This result was expected, given that Afghanistan has experienced decades of conflict and persistent socioeconomic instability.[5] Additionally, poor TB knowledge, the stigma associated with the disease, and inadequate access to mental healthcare services may also explain the high prevalence of depression symptoms documented in the study.[3,4,30] Findings such as this should lead to the inclusion of mental health screening services as a component of the National TB Elimination Program (NTEP).[6] Therefore, the current study advocates for dedicated mental health screening and counseling services for TB patients in Afghanistan.

In line with previous studies,[11,12,18] this study showed an inverse relationship between depression symptoms and education level. Patients with no formal education were 3.18 times more likely to have depression symptoms compared to those with formal education. Educational attainment has long been considered a key determinant of health literacy, enabling individuals to access crucial health information and effectively utilize healthcare services.[31] Patients with lower educational levels tend to report inadequate TB knowledge and higher TB-related stigma, which may be the cause.[30,32] In Afghanistan, mental health interventions to screen for depression symptoms should prioritize TB patients with low education levels.

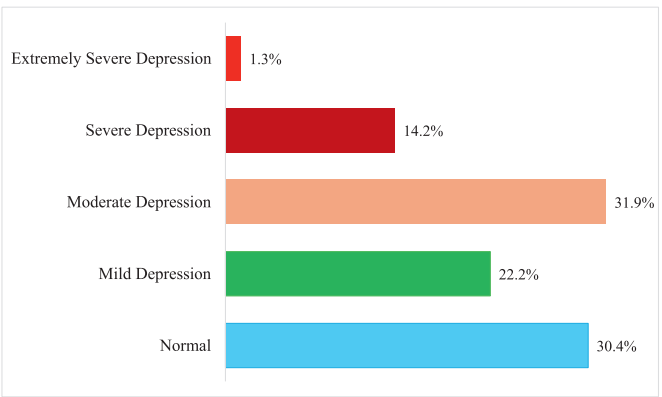

Fig. 1. Prevalence of depression symptoms among TB patients in Southern Afghanistan.

Also, this study showed that patients with a severe perception of their illness have higher odds of depression symptoms. This finding is consistent with previous studies conducted in Ethiopia,[33] and India.[16] In a community-based cross-sectional study conducted in 48 LMICs, the prevalence of depressive episodes was 23.7% higher in TB patients

Table 3
Logistic regression analysis on results of depression symptoms among TB patients; crude and adjusted odds ratios with 95% CIs.

Characteristics	Categories	Depression		COR (95% CI)	*P*-Value	AOR (95% CI)	*P*-Value
		Yes	No				
Sex	Male	310	167	1	0.003	–	–
	Female	388	138	1.51 (1.15–1.98)			
Residence	Rural	385	153	1	0.145	–	–
	Urban	313	152	1.22 (0.93–1.60)			
Education status	Educated	257	145	1	0.001	1	<0.001
	Uneducated	441	160	1.55 (1.18–2.04)		3.18 (2.35–4.30)	
Employment status	Employed	286	212	1	<0.001	–	–
	Unemployed	412	93	3.28 (2.46–4.37)			
TB type	Pulmonary	580	243	1	0.194	–	–
	Extrapulmonary	118	62	1.25 (0.89–1.76)			
Disease severity	Severe	569	196	2.45 (1.81–3.31)	<0.001	1.84 (1.30–2.59)	0.001
	Not severe	129	109	1		1	
Counseling during treatment	Yes	498	239	1	0.021	–	–
	No	200	66	1.45 (1.05–1.99)			
Comorbidity	Yes	149	47	1.49 (1.04–2.13)	0.029	1.88 (1.29–2.74)	0.001
	No	549	258	1		1	
Experienced TB drug side effects	Yes	202	55	1.85 (1.32–2.58)	<0.001	–	–
	No	496	250	1			
Social support	Low	499	169	2.01 (1.52–2.66)	<0.001	1.69 (1.22–2.33)	0.001
	High	199	136	1		1	

Abbreviations: TB, Tuberculosis; COR, Crude Odds Ratio; AOR, Adjusted Odds Ratio; CI, Confidence Interval.

having a severe condition.[7] The link between the illness perception and the risk of depression is also established in other chronic medical conditions.[34] In terms of policy relevance, screening and management of depression among patients with severe TB are highly recommended to alleviate suffering.

The odds of depression symptoms were higher among TB patients with a comorbid medical condition. The association between medical comorbidity and depression symptoms in TB patients is widely reported across studies in LMICs.[6,11,12,18] Patients with multimorbidity often experience higher depression symptoms due to increased physical burden, chronic pain, and the stress of managing multiple health conditions.[35] The chronic nature of multiple medical conditions can exacerbate depression symptoms.[36] Given this finding, healthcare providers for managing TB cases should pay more attention to patients with comorbid medical conditions in Afghanistan.

In addition, our study showed that patients with poor social support were more likely to experience depression symptoms. In addition, an overwhelming majority (66.6%) of the patients reported their social support as being lower. This finding is in agreement with studies conducted in China,[37] Sub-Saharan Africa,[15] and India.[38,39] Previous studies have also provided evidence for the crucial role of social support in improving adherence to anti-TB treatment and enhancing quality of life.[4,40] These findings suggest that the availability of social support may protect against the negative impact of TB on mental health problems. Leveraging social support in prevention and treatment options may reduce the burden of mental health symptoms among TB patients, and may therefore be worth investing in.

The limitations of the study were that depression symptoms were self-reported. Therefore, the prevalence of depression symptoms may be biased. Despite this, PHQ-9, as a diagnostic tool for depression symptoms, has good psychometric properties.[26] Furthermore, we did not assess the use of anti-depressants, which could lead to the misclassification of some patients. Moreover, in this study, we have only included drug-sensitive patients. Previous studies have shown that patients with drug-resistant TB have more severe depression symptoms.[11,12] Finally, the cross-sectional nature of the study precludes a causal relationship between depression symptoms and the correlates identified in the study.

5. Conclusion

In this study, more than two-thirds (69.6%) of TB patients had depression symptoms. Participants with lower education levels, severe disease, medical comorbidities, and poor social support were more likely to have depression symptoms. The findings call for immediate mental health interventions tailored to the socio-political realities of Afghanistan. Additionally, the study advocates for dedicated mental health screening and counseling services for TB patients in Afghanistan.

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Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Figures/Illustrations/Photographs

Photographs of 300 dpi or higher resolution may be submitted as 'jpeg', or 'tiff ' files in a zipped folder. In clinical photographs, identity of the subjects should be suitably masked; in case this is not possible, a written permission from the concerned person should accompany the manuscript.

Legends to Figures

The figure number (numbered consecutively in Arabic numerals), title and explanations of the figures should appear in the legend (not on the figure). Type the legends on a separate page. Enough information should be included to interpret the figure without reference to the text.

Units

All measurements must be in metric units, preferably with corresponding SI units in parentheses.

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All articles submitted to the Journal undergo initial review by the Editor and articles that are outside the scope of Journal or are not in the journal format are excluded. Later each article is reviewed by at least two reviewers. The time to first decision is usually less than 12 weeks.

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Correspondence

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