

Risk Factors for the Occurrence of Depressive Disorders in Pediatric Patients With Tuberculosis

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Background: Tuberculosis (TB) is one of the oldest and most persistent infectious diseases, continuing to pose a significant public health challenge worldwide. Children diagnosed with TB are particularly vulnerable to developing depressive disorders, which can significantly reduce their quality of life and negatively affect treatment adherence and recovery. This study aimed to identify risk and prognostic factors associated with depressive disorders in pediatric patients diagnosed with tuberculosis through a prospective analysis.

Materials and Methods: A prospective study was conducted on 190 pediatric patients, aged 7 to 18 years, diagnosed with tuberculosis and treated at the Pneumophthisiology Hospital in Galați, Romania, between 2019 and 2021. The CDI (Children's Depression Inventory) was administered to assess depressive symptoms over the course of the study.

Objective: The study aims to determine the prevalence of depressive disorders in children and adolescents by analyzing risk factors such as age, gender, place of origin, and access to medical services, as well as the effectiveness of CDI as a diagnostic tool. It also seeks to correlate clinical and demographic data with CDI scores and evaluate changes over time to identify solutions that support early diagnosis and intervention.

Results: Out of the initial 190 patients, 158 completed the CDI, as some did not return for follow-up evaluations or declined to participate. Of these, 146 (92.4%) demonstrated clinically significant depressive symptoms. Key risk factors for depressive disorders included a rural background, male gender, and age between 15 and 18 years.

Conclusion: Specific risk factors and vulnerabilities contribute to the development of depressive disorders in pediatric TB patients. Early identification and monitoring of these factors in a prospective framework are essential for improving the prognosis of both depression and tuberculosis, ultimately enhancing the overall outcomes for affected children.

Keywords: children's depression inventory, pediatric depression, tuberculosis, risk factor

Introduction

Tuberculosis (TB) is one of the oldest known infectious diseases and remains a major public health problem worldwide.^{1,2} Although significant progress has been made in diagnosis and treatment, TB continues to affect millions of people annually, including a significant number of children. In the modern context of public health, TB is no longer only a medical problem, but also a psychosocial one, profoundly affecting the lives and well-being of patients.

Children diagnosed with TB are particularly vulnerable to developing depressive disorders, which can significantly reduce their quality of life, negatively influence adherence to treatment, and hinder complete recovery.³ Addressing these psychological challenges is essential to improving both clinical outcomes and the overall well-being of affected children.³

Beyond the physical impact of TB, the psychological consequences are often neglected. Screening for depressive symptoms in children with TB is critical, as these disorders can complicate recovery if left unaddressed.

There are several screening tools used to assess depressive symptoms in children. These include the Children's Depression Inventory (CDI), the Beck Depression Inventory for Youth (BDI-YS) and the Children's Self-Assessment Scale (CIS). These tools have been validated in various populations and are used to detect depressive symptoms in children with TB.⁴

The Children's Depression Inventory (CDI)⁵ is particularly valuable in diverse contexts such as schools, outpatient clinics, psychiatric hospitals, and child protection services. Studies confirm its utility in clinical research and screening as part of a comprehensive assessment. Ethical considerations for its administration include informed consent and post-test feedback, with results communicated to patients and their guardians to guide further management.

While the CDI is frequently used and valued for its role in identifying depressive symptoms in children and adolescents,^{6–8} it has limitations in sensitivity and specificity, as highlighted by some studies.^{9–12} For homogeneous clinical samples, Kovacs recommends using a cut-off point of 12 or 13, though variations have been reported in different populations.^{13–15} For instance, a study involving Chinese adolescents suggested a cut-off point of 20 to better identify depressive symptoms in their sample.^{16,17}

This paper focuses on identifying statistically significant indicators, risk factors, and potential influences on the occurrence of depressive disorders in pediatric patients diagnosed with pulmonary TB. It explores correlations between these disorders and individual characteristics such as socio-demographic factors, weight, height, body mass index, and history of TB infection.

ommunicated to patients and their guardians to guide further management.

We will present the statistically significant correlations, in relation to a series of individual characteristics of the subjects in the study group, including socio-demographic particularities, scalar variables such as weight and height, body mass indices and history of TB infection.

Materials and Methods

Patient Population

The study was conducted on a cohort of 190 patients aged 7 to 18 years, diagnosed with tuberculosis (TB) and treated between January 2019 and December 2021. Patients were recruited from the following medical units:

- Pneumophthisiology Hospital Galați
- Pneumophthisiology clinics in Galați, Tecuci, and Tg. Bujor.

Inclusion Criteria

- Pediatric patients (7–18 years old) with clinically and paraclinically confirmed TB.

Exclusion Criteria

- Patients over 18 years of age.
- Refusal to participate or provide the necessary information.
- Patients who passed away during the study.

Evaluation Methods

The evaluations were conducted in three distinct stages to identify and monitor the risk of depressive disorders (Figure 1):

1. T0 (Initial evaluation):
 - Conducted at the time of patient registration.
 - Patients underwent an anamnesis interview consisting of 10 questions aligned with the key points of the CDI questionnaire to identify early signs of depression risk.

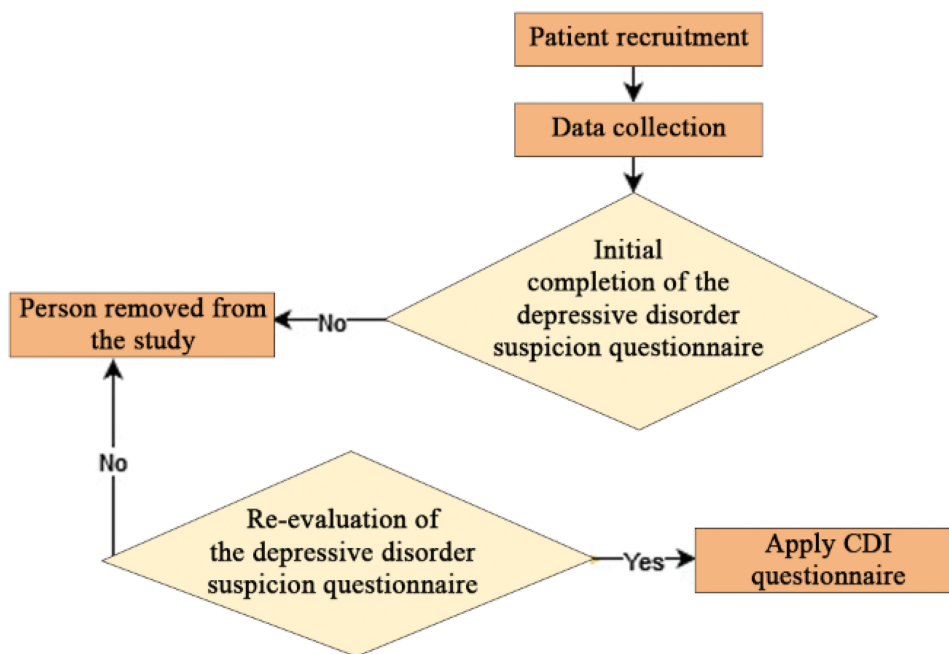


Figure 1 Workflow diagram.

2. T1 (First reassessment):

- Performed during the first follow-up visit to the pediatric pulmonology department after initiating therapy.
- The same 10-question interview was repeated to identify potential new signs of depressive disorders.

3. Final evaluation (CDI):

- The CDI questionnaire (short version, 10 items) was applied to all patients who remained under observation. CDI results were used to formulate hypotheses regarding individual risk factors for depression. At the end of the questionnaire, a primary assessment will be carried out based on the interpretation of the total score and an individual assessment of the 5 subscales (Table 1).

Assessment Tools

Children's Depression Inventory (CDI)

Developed by Maria Kovacs, CDI is a validated tool for identifying depressive symptoms in children and adolescents.^{18–20} In this study, the short version (10 items) adapted for Romanian use by Ph.D. Cristian Sârbu and M.Sc. Daniela Iliescu was utilized.

CDI assesses the severity of depressive symptoms on a scale from 0 to 54, with varying cut-off points depending on the population:

Table 1 CDI Scale Description

Factorial Scale	Measured Factor
Scale A	Negative disposition
Scale B	Interpersonal problems
Scale C	Inefficiency
Scale D	Anhedonia
Scale E	Low self-esteem

- Clinical threshold: 13 (clinical samples).
- Non-clinical threshold: 19–20.

Tuberculosis Diagnosis

The TB diagnosis was confirmed using:

- Imaging Tests: Chest X-rays performed with the DRGEM GXR-SD device.
- Biochemical and Hematological Tests: Conducted in the Medical Analysis Laboratory of the Pneumophthisiology Hospital Galați, using the Vitros 4600 analyzer (biochemical tests) and the Celltac analyzer (hematological tests).
- The type of TB was determined based on age:
- Children under 14 years: predominantly primary infection or primary TB.
- Over 14 years: secondary forms, according to WHO criteria.

Data Collection and Analysis

Data Collection

Demographic, clinical, and paraclinical data were collected from patient observation sheets and supplemented with individual follow-up records.

Statistical Analysis

Collected data were centralized in a Microsoft Excel table and analyzed using SPSS software (version 24). Statistical analysis included:

- Descriptive statistics: mean, median, standard deviation, range.
- Correlation and analytical tests: Chi-square tests, Pearson correlations, and ANOVA to identify significant relationships between variables.
- Graphical representations: histograms.

Ethical Considerations

- The study was conducted in compliance with national and international legislation (WHO, EU, Helsinki Declaration) on research involving human subjects.

Approvals

- Bioethics Committee approval from the Pneumophthisiology Hospital Galați.
- Written consent obtained from legal representatives of patients (for data collection and questionnaire completion) and management of the medical units (for access to archived records).

Patient Group Subdivisions

The main patient cohort was subdivided into categories relevant for statistical analysis, including:

- Age group (7–14 years vs 15–18 years).
- Type of TB (primary infection, primary TB, secondary TB).
- Clinical parameters (vital status, body mass index, medical history).

Results

The following section presents the descriptive analysis of the scales used for the six factors of the CDI test. This data provides a general perspective on the distribution of scores and variability within the analyzed sample (Table 2):

- The CDI questionnaire was applied to a total of 158 pediatric patients diagnosed with pulmonary TB, due to the lack of presentation of the patients for re-evaluation or the refusal to complete the questionnaire.
- The negative disposition scale obtained a mean value (MV) of 4.18 points, with an associated standard deviation (SD) of 2.50.
- Interpersonal problems are characterized by an average score of 2.16 points, with an SD of 1.72 points.
- The variable that analyzes the degree of inefficiency of the subjects obtained a MV of 3.01 points and an SD of 1.97 points.
- Anhedonia is defined by values of descriptive parameters such as MV of 5.37 and SD of 3.20.
- Low self-esteem had a MV of 2.77 and an SD of 1.36.
- The final column shows the distributions of the total values of the points obtained from the CDI score, with a MV of 17.54 points, a median of 18 points and an SD of 8.70 points. The distribution of values is between a minimum value of 0 points and a maximum value of 44 points.

Following the analysis of the items of the CDI questionnaire, we identified the following values:

- The negative mood scale has a maximum incidence value of around 4 points.
- Interpersonal problems scale has a maximum incidence of cases at the value of 3 points.
- Inefficiency with the predominance of cases below the value of 5 points (the maximum incidence at 2 points), with a maximum extreme of 8 points.
- Anhedonia with the predominance of cases located between the values of the scores of 5–8 points (these also representing the maximum incidence peaks). Patients who have reached the extreme value of 15 points stand out.
- Low self-esteem indicated the prevalence of cases below the threshold value of 4 points (with a maximum incidence peak of around 2 points).
- The maximum incidence peaks are located around 22 points and 11 points.

Table 2 Values of the Scalar Indicators Obtained From the CDI Questionnaires

		Negative mood Scale	Interpersonal Problems	Inefficiency	Anhedonia	Low Self Esteem	Total Value of Points Resulting Following to the Score
N	Valid	158	158	158	158	158	158
	Missing	32	32	32	32	32	32
Mean		4.18	2.16	3.01	5.37	2.77	17.54
Median		4.00	2.00	3.00	5.50	3.00	18.00
Std. Deviation		2.501	1.725	1.971	3.207	1.369	8.705
Variance		6.253	2.975	3.885	10.286	1.875	75.779
Skewness		0.400	0.619	0.472	0.373	0.914	0.306
Std. Error of Skewness		0.193	0.193	0.193	0.193	0.193	0.193
Kurtosis		-0.029	0.158	-0.378	-0.043	1.315	-0.207
Std. Error of Kurtosis		0.384	0.384	0.384	0.384	0.384	0.384
Minimum		0	0	0	0	0	0
Maximum		12	8	8	16	8	44

Figure 2 shows a graphical schematization of the significance of interpreting the results obtained from the CDI tests. It is noted that 32 CDI questionnaires were not applied to patients for whom it was not considered necessary, according to the attending physician.

As for the group of patients, 146 of the 158 who received CDI showed important clinical significance for depressive disorders.

To illustrate the relationships between various demographic and clinical variables and two main outcomes the decision to administer the CDI and the clinical significance of the CDI correlations were performed, expressed using Pearson's coefficient, considering statistical significance (p-values for the two-tailed test) and the number of cases included in the analysis (N = 190). Coefficients marked with * indicate statistical significance at the 0.05 level, while those marked with ** indicate significance at the 0.01 level (Table 3).

The identification of statistically significant correlations between the aforementioned variables revealed essential information for understanding the phenomenon studied.

Following the analysis conducted, our hypotheses that risk factors such as age, gender, and place of origin have an impact on the occurrence of depressive disorders in patients with tuberculosis have been confirmed:

1. There are extremely statistically significant correlations between the decisions to perform the CDI and the age groups of the subjects (sig = 0.000*), the conclusions of the questionnaires applied during the reassessment (sig = 0.000*) and the clinical significance of the depressive disorders detected when interpreting the CDI results.
2. Extremely statistically significant correlations were observed between the "Clinical significance of CDI" and the age groups of patients (sig = 0.001*), the conclusions reached at T1 (sig = 0.000*) and the decision to perform CDI (sig = 0.000*).
3. Pearson-type correlations were significant for sig < 0.05 between the "Clinical significance of CDI" and the conclusions found at baseline T0.

The results highlight the importance of the clinical context and reevaluations in decisions regarding CDI application, indicating that the clinical significance of CDI scores is strongly influenced by variables such as age and findings from the assessment stages. This approach can support more well-informed decisions in the diagnostic and intervention process.

To illustrate the demographic and contextual factors that may influence suspicion and detection of depressive disorders in children and adolescents, we conducted a detailed analysis of diagnostic conclusions at the initial assessment (T0) and reevaluation (T1), decisions regarding CDI application, and the clinical significance of the results obtained (Table 4).

The majority of suspected cases of depressive disorders and CDI applications are reported in rural areas, which may suggest limited access to specialized services or environmental factors affecting mental health. Regarding the distance to

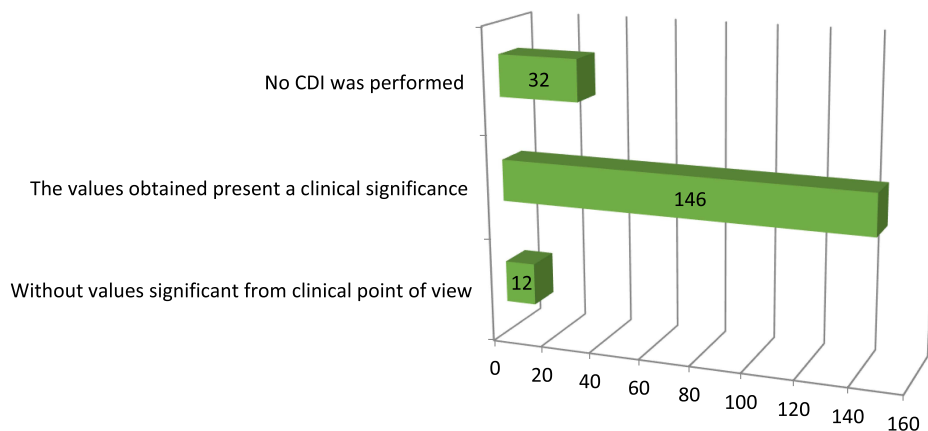


Figure 2 Graphical presentation of the indicators of clinical significance obtained from the CDI questionnaires.

Table 3 Pearson Correlations – Decision to Perform the CDI / Clinical Significance of the Test in Relation to Socio-Demographic Characteristics, Respectively conclusions T0, T1

Correlations		Origin Environment	Age Groups	Gender	T0 Conclusion	T1 Conclusion	Decision to Perform CDI	Clinical Significance of CDI
Decision to perform CDI	Pearson Correlation	0.044	-0.265**	0.047	-0.103	-0.374**	1.000	-0.858**
	Sig. (2-tailed)	0.545	0.000	0.523	0.157	0.000		0.000
	N	190	190	190	190	190	190	190
CDI clinical significance	Pearson Correlation	0.003	0.231**	-0.094	0.149*	0.441**	-0.858**	1
	Sig. (2-tailed)	0.972	0.001	0.199	0.040	0.000	0.000	
	N	190	190	190	190	190	190	190

Notes: *Correlation is significant at the 0.05 level (2-tailed). **Correlation is significant at the 0.01 level (2-tailed).

medical services, a decrease in CDI application and suspicion of depressive disorders is observed as the distance from services increases, highlighting the importance of geographical accessibility.

When analyzing the age groups of individuals at risk of depression, the highest proportion is found among adolescents aged 15–18 years, suggesting increased vulnerability in this category.

In order to facilitate the understanding of the documentation, we will present the conclusions in a phased manner, correlating them with the assumptions mentioned in Table 3. Thus, regarding the decision to perform the CDI (in 158 subjects, excluding 32 patients), the following are noted:

1. The CDI was performed predominantly for subjects from rural areas ($n = 110$), with a percentage difference of 39.24% compared to subjects from urban areas. This can be justified by the reduced access to medical services in rural areas, which can lead to the non-observance of clinical signs that indicate the appearance of depressive disorders. Also, the rural environment can contribute to social isolation due to the stigma associated with such a diagnosis. This isolation, combined with the loss of typical rural activities (working in the fields, caring for animals), can accentuate affective disorders.
2. The CDI was performed mostly in patients who lived less than 10 km from the monitoring health unit. Although there is no statistical significance regarding the interaction of these two variables, it can be assumed that the SARS CoV-2 pandemic made it difficult to monitor the subjects.
3. The distribution of decisions to perform CDI was almost symmetrical between the sexes, with a slight predominance among male subjects ($n = 84$).
4. The age groups of patients represent a variable with extremely strong statistical significance in the decision to perform the CDI. An ascending distribution of CDIs performed in subjects aged 15–18 years is observed ($n = 67$).

The clinical significance of CDI and the interpretation of the results obtained by patients show statistically and qualitatively significant distributions for several analyzed parameters:

1. There is a percentage difference of 36.98% that indicates the association of CDI values with clinical significance of affective disorders for subjects from rural areas.
2. The clinical significance of CDI was predominant in subjects residing less than 10 km from the healthcare facility ($n = 45$).

Table 4 Incidence Rate of CDI Decisions / Clinical Significance of the Test in Relation to Socio-Demographic Characteristics, Respectively Conclusions T0, T1

		Conclusion T0		Conclusion T1			Decision to Perform CDI		CDI Clinical Significance		
		There is no suspicion on occurrence of depressive disorders	It is identified the suspicion on occurrence of depressive disorders	There is no suspicion on occurrence of depressive disorders	It is identified the suspicion on occurrence of depressive disorders	T1 was not performed	It is not performed	Performed	Without values significant from clinical point of view	The values obtained present a clinical significance	No CDI is performed
Origin environment	Rural	16	118	33	93	8	24	110	10	100	24
	Urban	3	53	6	48	2	8	48	2	46	8
Distance towards medical services	Under 10 km	5	56	10	46	5	13	48	3	45	13
	Between 11 and 30 km	3	43	13	30	3	9	37	2	35	9
	Between 31 and 50 km	5	14	3	14	2	3	16	2	14	3
	Between 51 and 100 km	5	38	8	35	0	6	37	3	34	6
	Over 101 km	1	20	5	16	0	1	20	2	18	1
Gender	Male	7	96	21	75	7	19	84	4	80	19
	Female	12	75	18	66	3	13	74	8	66	13
Age groups	7–10 years	4	36	10	29	1	3	37	3	34	3
	11–14 years	7	49	9	46	1	2	54	4	50	2
	15–18 years	8	86	20	66	8	27	67	5	62	27

3. Most male pediatric patients have clinically significant CDI scores ($n = 80$).
4. The distributions of clinical significance of CDI tests maintain the same upward trend relative to patient age groups, similar to the decisions to perform the CDI.

The analysis of the underlying table allows the conclusion that suspicions of affective disorders among patients (assessed at T0 and T1) are confirmed by previous data. Thus, the profile of the pediatric patient with TB can be defined, which is at the highest risk of developing depressive disorders later confirmed by CDI. The majority profile is of a male patient, coming from rural areas, residing less than 50 km from the attending physician, and aged between 15–18 years.

To provide an overview of the correlation between clinical and psychological data, a table was created to present the analysis and evolution of clinical, psychological, and diagnostic parameters of the subjects evaluated at two distinct time points: T0 (initial assessment) and T1 (follow-up assessment) (Table 5). This table is structured to highlight the following aspects: suspicions regarding the onset of depressive disorders and decisions regarding CDI administration, the scores obtained on various psychological scales, as well as medical and psychological parameters associated with each subject. Additionally, it includes the total CDI score and the clinical significance of the results.

1. The average age of patients is 14 years old in both situations.
2. The patients recorded an average number of 5 visits to the attending physician for assessment/re-assessment until suspicions were established.
3. The mean weight of the subjects was 48 kg (T0) and 59 kg (T1).
4. The mean value of IDR was 11 mm for both patient categories.
5. For both groups of subjects, it was recorded an average number of 2 cardiopulmonary radiographs performed until suspicions were established.
6. The oxygen saturations, established in the atmospheric air, maintained a mean value of 98%.
7. The average number of affirmative items in the questionnaires was 6.
8. The total (mean) value of the CDI score for patients at risk of depressive disorders was 18 points, distributed as follows:
 - Negative mood scale: MV of 4 points for both situations.
 - Interpersonal problems: MV of 2 points.
 - Inefficiency: MV of 3 points.
 - Anhedonia: MV of 5 points for T0 and 6 points for T1.
 - Low self-esteem: MV of 3 points for both situations.

To enable a comparative analysis of the age distribution between the two groups: without suspicions of depressive disorders and with suspicions of depressive disorders - a histogram was created for both time points, T0 and T1. These graphs provide insight into the relationship between age and the prevalence of suspicions of depressive disorders (Figures 3 and 4).

Figure 5 illustrates the age distribution of patients for whom CDI was required, and Figure 6 shows the distribution of CDI scores, confirming previous conclusions.

All these data reinforce the previous conclusions, demonstrating through descriptive statistical analysis that the incidence values allow the formulation of working hypotheses for the analyzed batch:

1. It is essential to know the socio-demographic characteristics and age of patients (in completed years), as these factors are parameters of interest for clinical research.
2. After classifying patients into risk groups, defined by the individual parameters mentioned above, scalar variables such as weight (expressed in kg) and IDR size (expressed in mm) are verified.
3. The initial questionnaire (T0) is carried out.
4. If the subjects obtain more than 50% affirmative answers, the T1 reassessment is continued.

Table 5 Incidence Rate of CDI Decisions / Clinical Significance of the Test, Respectively T0, T1 Conclusions in Relation to Scalar Indicators

	Conclusion T0		Conclusion T1			Decision to Perform CDI		CDI Clinical Significance		
	There is no Suspicion on Occurrence of Depressive Disorders	It is identified the suspicion on occurrence of depressive disorders	There is no Suspicion on Occurrence of Depressive Disorders	It is Identified the Suspicion on Occurrence of Depressive Disorders	T1 was not Performed	It is not Performed	Performed	Without values Significant from clinical Point of View	The values Obtained Present a Clinical Significance	No CDI is Performed
	Mean	Mean	Mean	Mean	Mean	Mean	Mean	Mean	Mean	Mean
Age expressed in full years	13	14	13	14	16	16	13	13	13	16
Number of presentation to medical unit	4	5	4	5	3	4	5	5	5	4
Actual weight in kg	48	48	49	46	59	57	46	43	46	57
IDR values expressed in mm	14	11	11	11	13	13	11	9	11	13
Chest x-ray_ no. of investigations	1	2	2	2	1	1	2	2	2	1
SaO2	98	98	98	98	98	98	98	98	98	98
Total items detected to T0	4	6	6	6	6	7	6	5	6	7
Total items detected to T1	4	5	3	6		5	5	4	5	5
Negative mood scale	4	4	4	4			4	1	4	
Interpersonal problems	2	2	2	2			2	1	2	
Inefficiency	2	3	2	3			3	1	3	
Anhedonia	6	5	5	6			5	2	6	
Low self-esteem	3	3	2	3			3	1	3	
Total value of points resulted following to performing CDI	17	18	15	18			18	5	19	

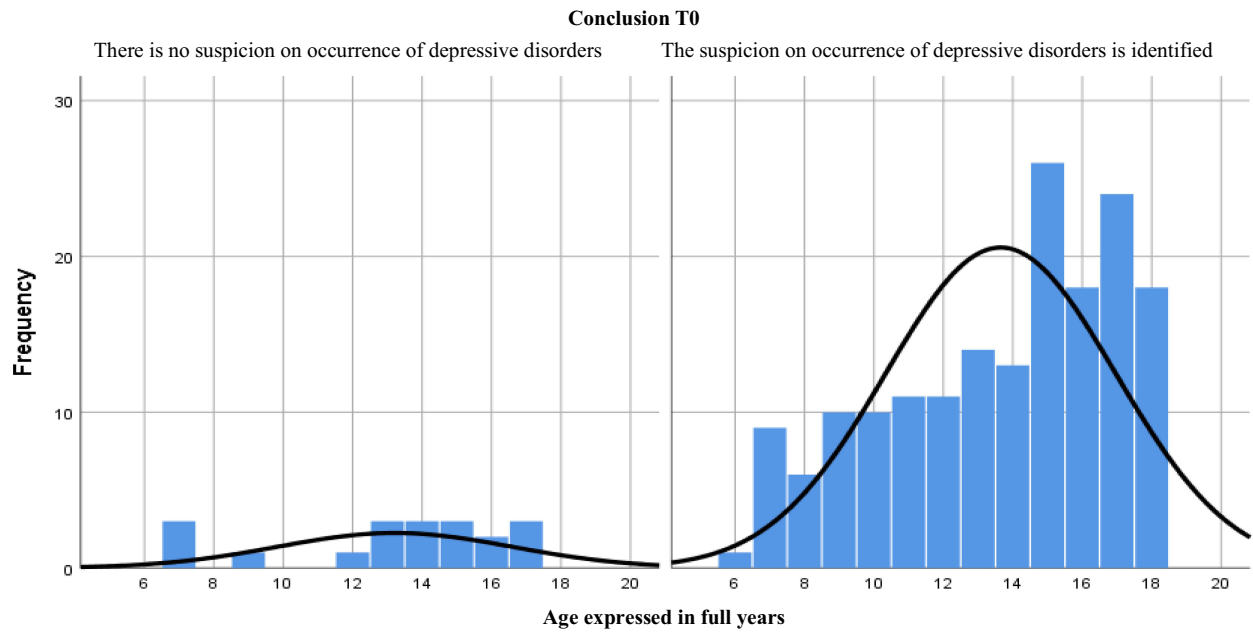


Figure 3 Histogram of the patients' ages at the time of recording, by comparative reference to the results obtained from the questionnaire at the time T0.

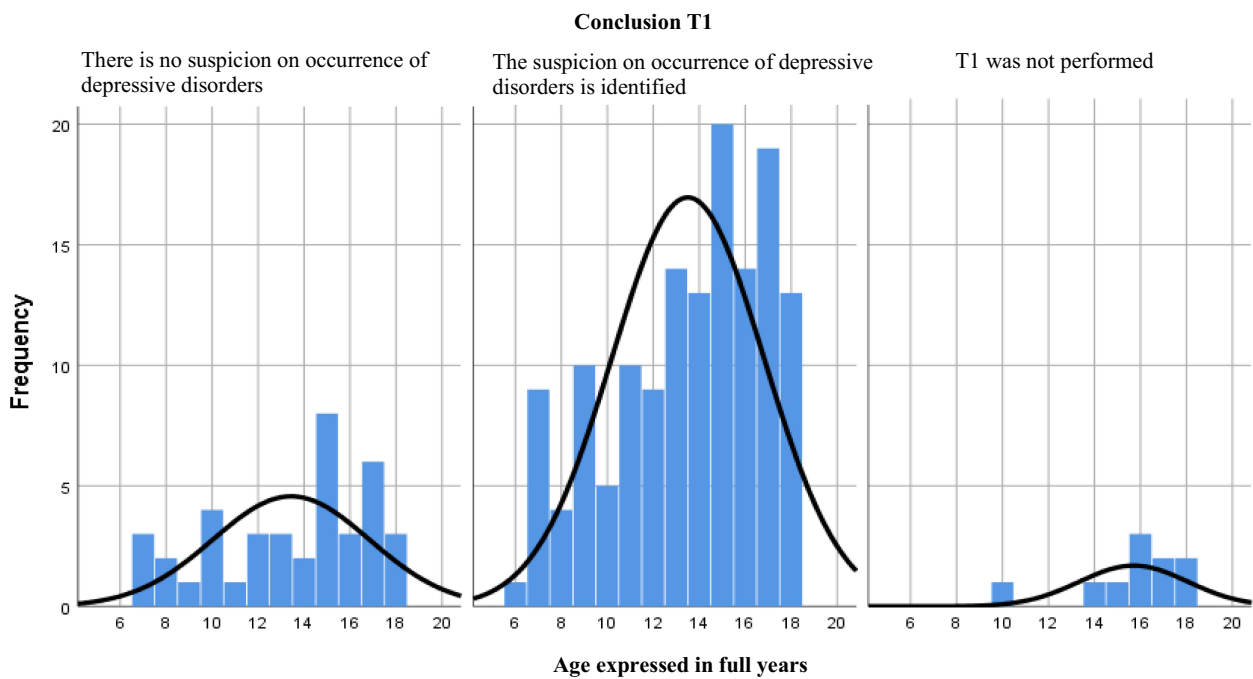


Figure 4 Histogram of patients' ages at the time of recording, by comparative reference to the results obtained from the questionnaire at the time of T1.

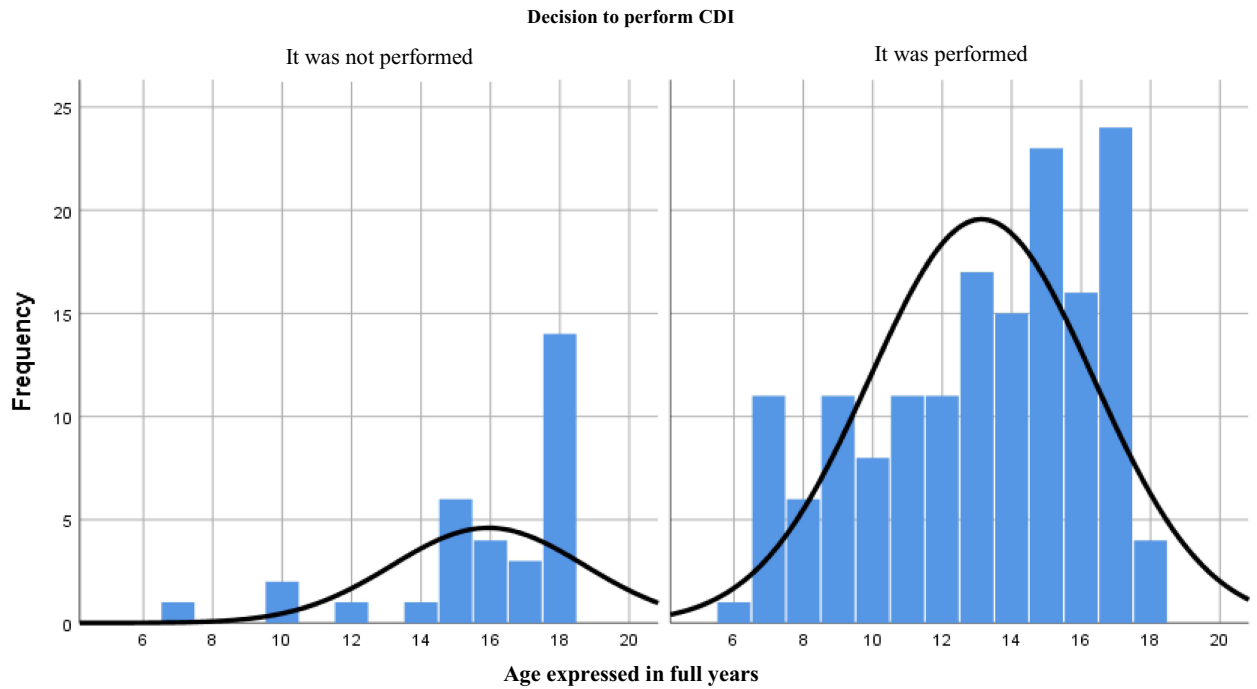


Figure 5 Histogram of patients' ages at the time of recording, by comparative reference to the decision to perform the CDI.

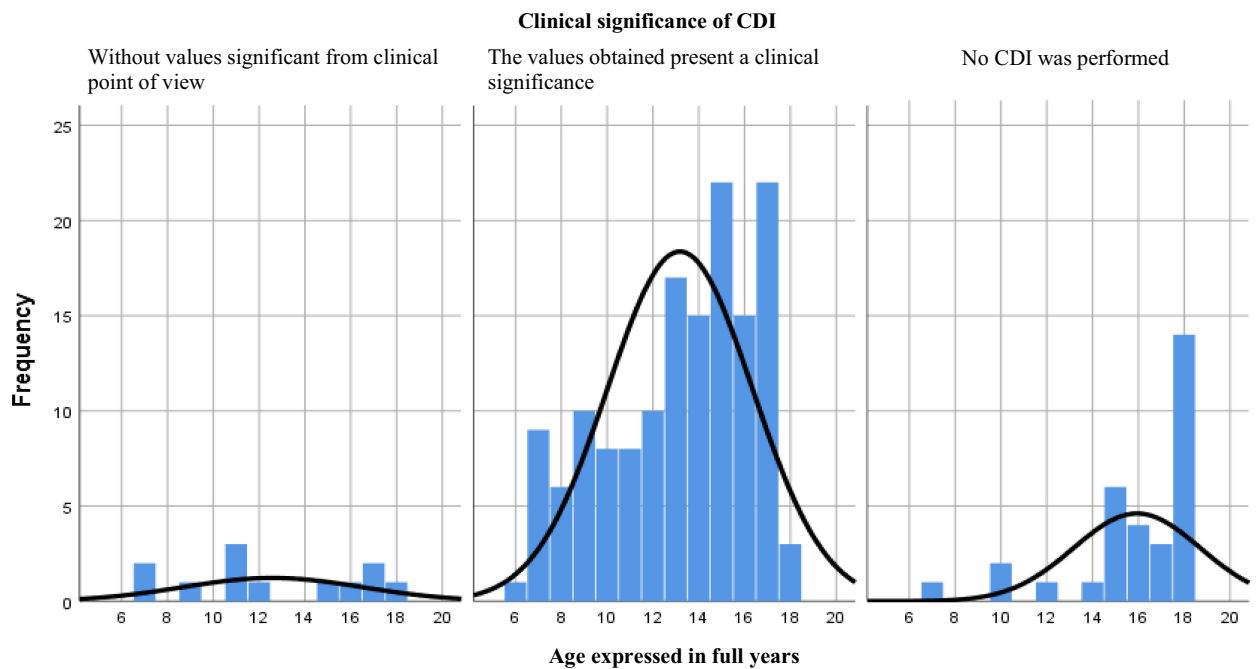


Figure 6 Histogram of the patients' ages at the time of registration, by comparative reference to the results obtained from the CDI questionnaire (its clinical significance).

5. If similar results are obtained at T1, the suspicion of developing pathologies on the spectrum of affective disorders, the need to perform the CDI and the initiation of collaboration with a psychiatrist and a pediatric psychologist for psychotherapy are raised.

With all this information, preliminary hypotheses can be made from the subjects' recording. Tables 6 and 7 summarize the conclusions previously obtained through bivariate correlations of the Pearson type and descriptive data. These tables allow a quick review of the conclusions, depending on the questionnaire evaluation stage (T0, T1, CDI):

1. The existence of personal pathological history (sig = 0.000*) and the reason for the initial presentation at US (sig = 0.031) are variables that define strongly statistically significant correlations with the occurrence of suspected depressive disorder at T0.
2. At T1, the same variables are relevant, with a sig of 0.042 for the existence of the APP and a sig of 0.026 for the reasons of presentation. The degree of reassessment of the subjects becomes a factor that can reduce the incidence of depressive disorders, with a MV of the number of presentations equal to 5 (sig = 0.001*).
3. The decision to perform the CDI is influenced by the age groups of the subjects (sig = 0.000*), by their responsiveness and collaboration (MV of the number of presentations being 5, with a sig of 0.004*), by significant APPs (sig of 0.024*) and by the type of TB pathology (sig = 0.024*).

Table 6 Summary Table of the Pearson Correlations Made Between the Conclusions Resulting From Performing T0, T1, CDI, Respectively a Series of Individual Variables Analyzed Within the Study Group

Correlations		Conclusion T0	Conclusion T1	Decision to Perform CDI	Clinical Significance
Distance towards medical services	Pearson Correlation	-0.029	-0.082	0.129	-0.137
	Sig. (2-tailed)	0.696	0.261	0.075	0.060
	N	190	190	190	190
Origin environment	Pearson Correlation	0.100	0.108	0.044	0.003
	Sig. (2-tailed)	0.170	0.137	0.545	0.972
	N	190	190	190	190
Age group	Pearson Correlation	0.031	0.072	-0.265**	0.231**
	Sig. (2-tailed)	0.670	0.323	0.000	0.001
	N	190	190	190	190
Gender	Pearson Correlation	-0.116	-0.038	0.047	-0.094
	Sig. (2-tailed)	0.110	0.607	0.523	0.199
	N	190	190	190	190
Number of presentations	Pearson Correlation	0.137	-0.011	0.205**	-0.184*
	Sig. (2-tailed)	0.060	0.879	0.004	0.011
	N	190	190	190	190

(Continued)

Table 6 (Continued).

Correlations		Conclusion T0	Conclusion T1	Decision to Perform CDI	Clinical Significance
Personal pathological history	Pearson Correlation	-0.291**	-0.148*	0.164*	-0.195**
	Sig. (2-tailed)	0.000	0.042	0.024	0.007
	N	190	190	190	190
Reasons for the presentation	Pearson Correlation	-0.157*	-0.162*	0.095	-0.152*
	Sig. (2-tailed)	0.031	0.026	0.191	0.037
	N	190	190	190	190
Epidemiologic context	Pearson Correlation	0.105	0.096	0.046	-0.009
	Sig. (2-tailed)	0.150	0.186	0.531	0.904
	N	190	190	190	190
Stage of the disease at the moment of registration	Pearson Correlation	0.034	0.033	-0.091	0.087
	Sig. (2-tailed)	0.638	0.656	0.210	0.234
	N	190	190	190	190
Type of TB pathology detected at the patients within the study	Pearson Correlation	0.033	-0.133	0.163*	-0.174*
	Sig. (2-tailed)	0.656	0.068	0.024	0.016
	N	190	190	190	190
Patient's re-assessment	Pearson Correlation	0.138	0.229**	-0.713**	0.610**
	Sig. (2-tailed)	0.057	0.001	0.000	0.000
	N	190	190	190	190

Notes: *Correlation is significant at the 0.05 level (2-tailed). **Correlation is significant at the 0.01 level (2-tailed).

4. Finally, the analysis of the degree of clinical significance of the CDI data shows the following statistically significant correlations, according to the Pearson indicator:

- The correlations previously observed in the decision to perform the CDI are maintained.
- There is an association with the subjects' initial reasons for presentation, such as TB contact in the history and TB-specific symptomatology. Thus, knowing the contact of TB, associated with specific symptoms, increases the risk of depressive disorders according to the CDI.

These conclusions allow the formulation of preliminary hypotheses and the definition of the socio-demographic and clinical characteristics of patients for clinical research.

Accordingly, it can be concluded that detailed knowledge of patient characteristics and careful monitoring of their evolution are essential for the correct management of pediatric TB patients. The implementation of early assessment and

Table 7 Summary Table of the Pearson Correlations Made Between the Conclusions Resulting From T0, T1, CDI, Respectively the Reasons for Patients Presenting to Hospital

		Conclusion T0		Conclusion T1			Decision to Perform CDI		CDI Clinical Significance		
		There is no Suspicion on Occurrence of Depressive Disorders	It is identified the Suspicion on Occurrence of Depressive Disorders	There is no Suspicion on Occurrence of Depressive Disorders	It is identified the Suspicion on Occurrence of Depressive Disorders	T1 was not Performed	It is not Performed	PERFORMED	Without Values Significant from Clinical point of view	The values Obtained Present a Clinical Significance	No CDI is Performed
Reasons for presenting to medical unit	Hyperergic reaction to tuberculin	0	2	0	2	0	2	0	0	0	2
	TB contact	17	165	36	136	10	30	152	11	141	30
	Cough with hemoptysis sputum	0	1	0	1	0	0	1	0	1	0
	Pleurisy	0	1	0	1	0	0	1	0	1	0
	Productive cough, dysphagia	0	0	0	0	0	0	0	0	0	0
	Dry cough, twinge in left hemithorax, weight loss	1	0	1	0	0	0	1	0	1	0
	T6 re-assessment	0	0	0	0	0	0	0	0	0	0
	Weight loss, dry cough, fever	0	1	1	0	0	0	1	0	1	0
	Hyperergic reaction to tuberculin, semi-productive cough	1	0	0	1	0	0	1	0	1	0
Fever, right thorax twinge, dry cough, fatigability	0	1	1	0	0	0	1	1	0	0	
Chi-square tests with sig. index	0.009*		0.493			0.134		0.024*			

Notes: *Correlation is significant at the 0.05 level (2-tailed).

intervention strategies can significantly contribute to the prevention and management of associated affective disorders, thus improving the prognosis and quality of life of patients.

Discussion

Depression represents a common mental disorder encountered among TB patients, being associated with a high risk of suicide, multidrug-resistant TB, and poor quality of life. Following the analyses, it was suggested that early identification of depressive disorders in TB patients is important for reducing adverse outcomes.²¹ Tuberculosis and depression have been conceptualized as syndemics: TB is frequently associated with depression, and depression increases the risk of TB reactivation and disease progression. This can be mediated by low socio-economic status, malnutrition, immunosuppression, and negative behaviors.²²

Results of cross-sectional studies (some conducted in hospitals in African countries) indicated a very high prevalence of comorbid depression (ranging from 10% to 52%) among TB patients.²³

Vulnerabilities in Pediatric and Adolescent Populations

Children

Hospitalization, isolation, and stigma significantly impact the mental health of children with TB, leading to long-term consequences such as depression and anxiety. A study by Chiang et al found that children undergoing TB treatment often reported feelings of sadness, disadvantage, and rejection due to social isolation.²³

Adolescents

Adolescents face unique challenges, including social pressures, fear of stigma, and difficulties adhering to treatment. They often internalize the stigma associated with TB, which impacts self-esteem and emotional well-being. Many adolescents perceive TB as a threat to their future, resulting in feelings of shame and negative attitudes toward themselves. These issues are compounded by the need to navigate the autonomy and independence required during adolescence.²⁴

There are several specific risk factors and vulnerabilities that may contribute to the development of depressive disorders in pediatric TB patients. These factors include:

Biological Factors

- *Family history of depression:* Children with a family history of depression are more likely to develop depressive disorders, suggesting a genetic and biological component.²⁵
- *Poor physical condition:* Medical complications associated with TB, such as weight loss, chronic fatigue, and physical pain, can contribute to the development of depressive symptoms.²⁶

Psychological Factors

- *Chronic stress:* TB diagnosis and associated treatment can generate a high level of chronic stress, which can trigger or worsen depressive symptoms.²⁷
- *Adjustment problems:* Children with TB may have difficulty adjusting to life changes imposed by the disease, such as school absences, social isolation, and changes in daily routine.²⁸

Social Factors

- *Social isolation:* Children with TB may experience social isolation because of the stigma associated with the disease or because of treatment restrictions. This isolation can contribute to feelings of loneliness and depression.²⁹
- *Family and community support:* A lack of adequate family and community support can exacerbate depressive symptoms and negatively impact a child's recovery.³⁰
- A study from Ethiopia found that patients with low social support were four times more likely to develop depression compared to those with stronger networks.³¹
- *Rural residence and low education levels:* Meta-analyses, including data from Romania, confirm these as significant risk factors.³²

- Female gender: Traditional gender roles and societal expectations often place additional emotional and social burdens on women, increasing their vulnerability to depression.^{33,34}

According to a meta-analysis that included 25 studies conducted in various countries around the world (Asia, Africa, Brazil, South America, Romania), between 2011 and 2021, the factors that contributed to the development of depressive disorders among TB patients were: female gender, weak social support, low education level, marital status, rural residence, and retreatment status.³⁵

According to a study conducted in Ethiopia, which included 409 participants, more than a third of them had attended primary school (40.3%), and 53.1% lived in rural areas.³⁶ The same study also highlighted that 34% (139 patients) had weak social support, and 43.3% (177 patients) had intermediate social support. Thus, we can see that patients who received low social support were 4 times more likely to develop depressive symptoms compared to those who received intermediate and strong social support.³⁷ According to a meta-analysis that included 8 articles, a strong link was found between depressive symptoms and negative TB treatment outcomes, also being associated with patients' loss during monitoring phase.³⁶ In addition to the challenges underlying mental health, the negative effects of tuberculosis often lead to depressive symptoms, negative attitudes, behavioral changes, and psychosomatic symptoms.³⁸

Research in Romania highlights that women, individuals residing in rural areas, and those undergoing retreatment are disproportionately vulnerable to depression.³⁹ Furthermore, the limited availability of mental health services in rural regions significantly amplifies these vulnerabilities.⁴⁰

A study conducted by the National Institute of Pulmonology "Marius Nasta" revealed that depression rates are higher among pediatric patients from rural areas, where access to mental health services is limited.⁴⁰ Moreover, the stigma associated with the disease plays a significant role in the development of depressive symptoms. Hospitalized children frequently reported feelings of isolation, sadness, and anxiety due to separation from their families and social restrictions.⁴¹

Another study conducted in counties with a high TB incidence (eg, Dolj, Galați, Vaslui) indicated that adolescents diagnosed with TB exhibit pronounced depressive symptoms, associated with academic and social difficulties. Approximately 40% of children with TB in rural areas exhibited symptoms of depression compared to 20% of those in urban areas, suggesting an important role of socio-economic factors.⁴²

In my study, the higher prevalence of depression among male TB patients compared to female patients, within the pediatric population, can be explained by several factors specific to the local context:

1. Demographic composition of the sample

In Romania, more male children are diagnosed with TB than female children, particularly in rural areas and socio-economically vulnerable groups. This trend aligns with official data indicating that male patients represent the majority of active TB cases, as they are more exposed to risk factors such as poor living conditions and malnutrition.⁴¹

2. Cultural and psychosocial factors

In many regions of Romania, male patients face greater challenges in expressing emotional symptoms or seeking psychological support due to the stigma associated with mental health disorders. This can lead to the underdiagnosis of depression until symptoms become more severe, potentially explaining the higher prevalence of depression in this group.⁴³

3. Social isolation and family responsibilities

Male patients from rural areas may experience a higher degree of social isolation, as they are often expected to contribute to family support, even at a young age. The disease limits their ability to fulfill this role, exacerbating feelings of inadequacy and stress.⁴²

4. Diagnostic approach

In my study, male patients were more frequently subjected to depression screening due to the higher prevalence of overt symptoms such as irritability and impulsive behaviors. This could explain why depression was more commonly identified in this group.

Validated self-report tools are essential for detecting depression among TB patients. Key instruments include: Children's Depression Inventory (CDI): Particularly effective for pediatric populations, with Romanian-adapted versions available,⁴⁴ Patient Health Questionnaire (PHQ-9/PHQ-2): Widely used for adolescents and adults,⁴⁵ and Mood and Feelings Questionnaire (MFQ): Effective in identifying mood-related symptoms in adolescents.⁴⁶

These tools are critical for standardized depression screening during TB treatment, ensuring early identification and intervention.

Recommendations for Improved Outcomes

1. Early screening and intervention:

- Combine psychological support with TB treatment to improve adherence and recovery rates.
- Incorporate counseling and psychotherapy as routine components of TB care. Studies from India demonstrate that psychotherapy during TB treatment significantly improves adherence and cure rates.⁴⁷

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3. Strengthening social support:

- Enhance family and community support through targeted programs and education campaigns to reduce stigma.
- Develop peer support groups specifically for children and adolescents undergoing TB treatment.

4. Policy and funding:

- Increase funding for mental health services, particularly in rural areas.
- Align Romanian TB programs with WHO recommendations on mental health care integration.

5. Awareness campaigns:

- Reduce stigma associated with TB and depression through educational initiatives in schools and communities.

Global studies have revealed that TB patients diagnosed and treated for psychological comorbidities adhere better to TB treatment. Depression is associated with poorer outcomes and an increased risk of treatment dropout.^{48–50} Treating the psychological aspects of TB can lead to better clinical outcomes. In a study from India, psychotherapy during TB treatment resulted in higher rates of adherence, treatment, and cure.³⁵ Psychological support as an intervention can improve adherence and completion of treatment.⁵¹

Conclusion

Addressing depression in TB patients, particularly among children and adolescents, requires a comprehensive, multi-faceted approach. By understanding and addressing biological, psychological, and social risk factors, healthcare providers can significantly improve treatment outcomes. Data from Romanian and international studies underscore the

urgent need for integrated care models that prioritize mental health alongside physical health in TB management. Through early screening, targeted interventions, and robust policy frameworks, the burden of TB and its mental health consequences can be effectively reduced.

Major risk factors for depression in my study is rural background, male gender, and ages 15–18 years.

The results of my study indicate an atypical distribution of depression among tuberculosis patients, with a predominance among men, contrary to global trends. This discrepancy can be explained by cultural, demographic, and socio-economic factors specific to the Romanian context. Integrating mental health into tuberculosis treatment, through the adoption of care models tailored to local needs, can significantly improve clinical outcomes and patients' quality of life. Comparing data from Romania with international findings highlights the necessity of a personalized approach that considers the specific characteristics of each population.

Data Sharing Statement

The information will be granted access to under reasonable request from the corresponding author.

Ethics Approval

All legal relatives of the patients gave their informed consent for inclusion before participating in the study. The study was carried out in accordance with the Declaration of Helsinki, and the protocol was approved by the Ethics Committee of the Pneumophthisiology Hospital in Galati (no. 78/04.01.2019).

Author Contributions

All authors made a significant contribution to this work, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

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