DOI https://doi.org/10.70280/njph(2025)v2i2.49

Clinical Profile and Determinants of Pulmonary and Extrapulmonary Tuberculosis: A Cross-Sectional Study

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ABSTRACT

Background: Tuberculosis continues to be a major global health problem, particularly in low- and middle-income countries. Both pulmonary and extrapulmonary forms present with diverse clinical manifestations that often complicate diagnosis and management. This study aimed to assess demographic characteristics, clinical features, and risk factors associated with pulmonary and extrapulmonary tuberculosis, and to explore their distribution across disease subtypes.

Methods: This inpatient cross-sectional study was conducted at Tribhuvan University Teaching Hospital, Kathmandu, Nepal, from July 2023 to April 2025. A total of 180 newly diagnosed tuberculosis patients were enrolled, excluding drug-resistant cases, co-infections, malignancies, and those already on treatment for more than one month. Demographic details, body mass index, smoking history, and clinical features were recorded using structured forms. Patients were classified as pulmonary or extrapulmonary tuberculosis, with further subtyping of extrapulmonary disease. Data were analyzed using chi-square, with p-values less than 0.05 considered significant.

Results: Males constituted 75 percent of cases, and half of the participants reported smoking. Pulmonary tuberculosis was identified in 119 patients, while 61 had extrapulmonary disease. Pleural involvement was the most frequent extrapulmonary subtype, followed by abdominal, central nervous system, and disseminated forms. Night sweats, malaise, fever, and cough were the most common symptoms overall. Neurological and gastrointestinal features were observed exclusively in extrapulmonary cases. Smoking showed a strong association with pulmonary tuberculosis (p = 0.004), while systemic symptoms such as malaise, confusion, abdominal pain, and night sweats were significantly associated with extrapulmonary disease.

Conclusion: Pulmonary and extrapulmonary tuberculosis demonstrate distinct clinical and demographic patterns. Smoking is an important determinant of pulmonary disease, while extrapulmonary tuberculosis presents systemic and atypical symptoms. Strengthening diagnostic capacity, addressing modifiable risk factors, and enhancing clinician awareness are essential for timely recognition and effective management.

Keywords: Clinical profile, determinants, extrapulmonary tuberculosis, pulmonary tuberculosis

Received on: 24 September 2025
Accepted on: 07 November 2025

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BACKGROUND

Tuberculosis is considered to be one of the major infectious diseases in the world with an estimation of 10 million new infections and 1.57 million deaths, the disease burden is estimated to be disproportionately high in low and middle-income countries, and TB is categorized into two, namely, pulmonary TB (PTB), and extrapulmonary TB (EPTB) (1-3) .The clinical spectrum of TB is influenced by several factors including

age, sex, nutritional status, and smoking habits along with pathogen-specific features, although the similarity of the symptoms between PTB and EPTB, coupled with the variable sensitivity of diagnostic tests, may complicate the differentiation and therefore cause the delay of the appropriate treatment (4-6).

It is therefore that the demographic and clinical characteristics that come along with the PTB and EPTB are of special significance in enhancing case detection and management. This study aims to understand the demographic characteristics, clinical manifestations, and risk factors associated with PTB and EPTB. The findings will inform clinicians on the earlier diagnosis of TB in different manifestations by establishing important predictors and emerging trends, which will eventually lead to improved patient care and intensified disease control measures.

METHODS

The study was a cross-sectional, hospital-based study carried out at the Department of Internal Medicine, Tribhuvan University Teaching Hospital (TUTH), Kathmandu, Nepal. The patients who were admitted in July 2023 to April 2025 were used in the study and were tracked up to the close of the intensive phase of anti-tubercular therapy (ATT).

The sample population comprised of 180 patients who had either PTB or EPTB and had been in the outpatient and inpatient departments within the study period. The diagnosis of tuberculosis was done according to the national and international guidelines and consisted of both the bacteriologically confirmed cases and clinically diagnosed. Only newly diagnosed cases of tuberculosis and patients with complete clinical and demographic data were accepted to include in the study. Individuals who have a history of drug-resistant tuberculosis, and those with severe co-infections like HIV, hepatitis B or C as well as those with underlying malignancy were excluded. Also, patients who were already receiving anti-tubercular treatment of more than 1 month before their presentation were excluded to prevent bias because of treatment. Demographic data including age, sex, and the body mass index (BMI) was also placed in a system going through and capturing other lifestyle related variables like smoking status. Clinical record and direct clinical examination provided the clinical data of each individual patient as follows; common signs of fever, cough, malaise, night sweats, hemoptysis and weight loss, less common but significant signs included confusion, headache, neck stiffness, abdominal pain, and diarrhea. To enable any significant comparisons, the patients were divided into pulmonary tuberculosis and extrapulmonary tuberculosis. The group of pulmonary tuberculosis was further subdivided into the bacteriologically confirmed, which was determined by the positive results of the GeneXpert, sputum smear microscopy, or mycobacterial culture and the clinically diagnosed, which was identified by the help of the test results of radiological reveal or clinical suspicion confirmed by the subsequent therapeutic response. Further subtyping of extrapulmonary cases of TB was as pleural, abdominal, central nervous system, and disseminated disease, by clinical presentation, radiological appearance and where possible cytological or histopathological confirmation. Scheduling was also done in a consistent structured case record form to ascertain completeness and consistency. The clinical and demographics data were saved in a special database to be analyzed. The age and BMI are continuous variables; they were summarized using means and standard deviations, but the sex, smoking status or the presence/absence of symptoms are categorical variables; the data presented in the form of frequencies and percentages. The appropriate statistical tests were used to make comparisons between pulmonary and extrapulmonary tuberculosis. Chi-square test was used to determine the associations between the categorical variables whereas Fisher exact test was used where the expected frequencies were low. The independent t-test was used to make the comparison of continuous variables. All the analyses were conducted with the help of [statistical software: SPSS version 25]. The p-value below 0.05 was regarded as statistically significant two tailed.

The Institutional Review Committee (IRC) approval was taken from IRC of Institute of Medicine, Maharajgunj Medical Campus, Tribhuvan University with the approval No. 18 (6-11) E2/ 080/081). Informed consent was signed by all the participants or their representatives who have a legal right to sign informed consent before enrolling them. The study used confidentiality of patient data.

RESULTS

The number of participants in the study was 180. The study population had a mean age of 50.72 (age group from 0 to more than 90). The age group of 30-40 years had the highest number of 35. (Figure 1).

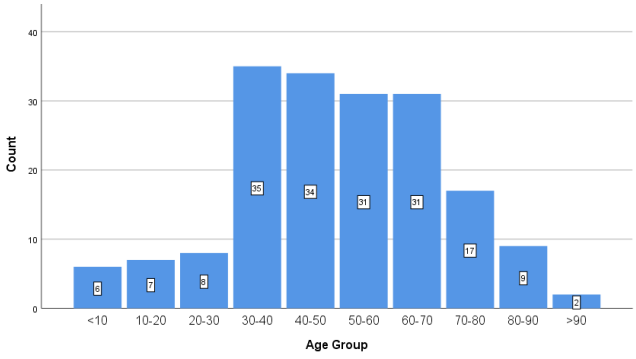

Figure 1. Distribution of tuberculosis cases across different age groups

The majority 135 (75 percent) were males and 45 (25 percent) were females. The body mass index (BMI) was more in participants of BMI >18 (155, 86.1%) than in those of BMI <18 (25, 13.9%). The participants who reported smoking are 90 (50%) (Table 1).

Table 1. Demographic characteristics of 180 tuberculosis patients stratified by age, sex, BMI, and smoking status

Paramters	Subgroup	Frequency
Age group in years	<10	6
	10-20	7
	20-30	8
	30-40	35
	40-50	34
	50-60	31
	60-70	31
	70-80	17
	80-90	9
	>90	2
Sex	Male	135
	Female	45
BMI	Less than 18	25
	More than 18	155
Smoking	Smoker	90
	Non-Smoker	90

Night sweats were the most seen in 166 patients followed by malaise (162), fever (138), Cough (135), weight loss (105) and hemoptysis (18) were present. In extrapulmonary TB, neurological symptoms were present such as confusion (8, 4.4%), neck stiffness (8, 4.4%), and headache (7, 3.9%). Other gastrointestinal complaints, such as abdominal pain (9, 5%) and diarrhea (9, 5%), were also limited to extrapulmonary instances. The type of tuberculosis was found to significantly associate with malaise, confusion, neck stiffness, headache, diarrhea, abdominal pains, and night sweats ($p < 0.05$) (Table 2).

Table 2. Clinical Features of included participants

Parameters	Total (n)	Pulmonary TB	Extrapulmonary TB	P value
Fever	138	50	88	0.85
Cough	135	86	49	0.86
Weight loss	105	67	38	0.87
Malaise	162	110	52	<0.001
Confusion	8	0	8	0.01
Neck Stiffness	8	0	8	0.00
Headache	7	0	7	0.01
Diarrhoea	8	0	9	<0.001
Abdominal Pain	9	0	9	<0.001
Night sweats	166	114	52	<0.001
Hemoptysis	18	12	6	0.75
Painless lymph node swelling	60	8	52	0.04

Of the total cases, 86 (47.8%) were bacteriologically confirmed pulmonary TB and 33 (18.3%) were clinically diagnosed with pulmonary TB. Extrapulmonary tuberculosis (EPTB) was identified in 61 (33.9%) participants. Among EPTB subtypes, pleural TB (37, 20.6%) was the most common, followed by abdominal (10, 5.6%), central nervous system (10, 5.6%), and disseminated TB (11, 6.1%) (Figure 2, Figure 3).

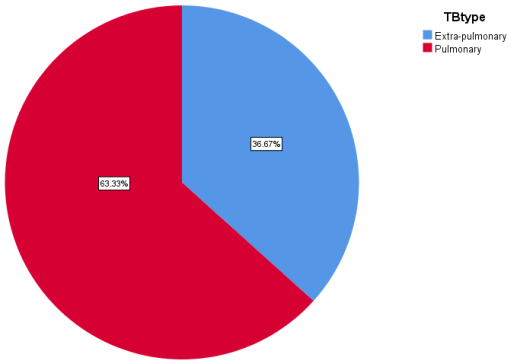

Figure 2. Pie chart showing the type of tuberculosis in included participants

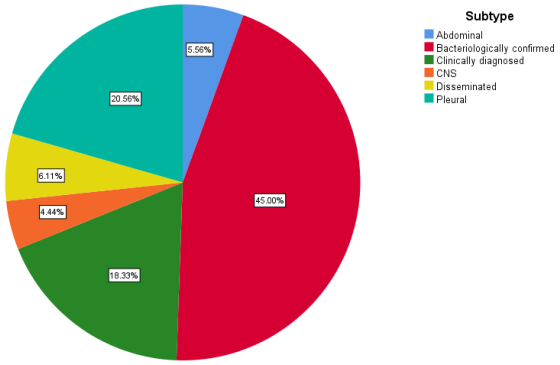

Figure 3. Pie chart showing the subtype of pulmonary and extrapulmonary tuberculosis

Age distribution showed that younger participants (0–20 years) were more likely to present with extrapulmonary TB, particularly CNS involvement (1 case), whereas older patients (80–100 years) exhibited higher proportions of pleural and disseminated TB. No significant sex-based differences were noted between pulmonary and extrapulmonary TB ($p = 0.99$). Low BMI was more frequent among extrapulmonary TB cases, although not statistically significant ($p = 0.24$). Smoking was strongly associated with pulmonary TB ($p = 0.004$), with 70 of 90 smokers presenting with pulmonary disease compared to only 20 with extrapulmonary disease.

Table 3: Association of baseline characteristics with type and subtype of Tuberculosis in included participants

Parameters		Pulmonary		Extrapulmonary				p-value
		Clinically Diagnosed (Pulmonary)	Bacteriologically Confirmed (Pulmonary)	Abdominal	Central Nervous System	Pleural	Disseminated (including lymphadenitis)	
Age	0-20	1	8	0	1	2	0	0.12
	20-40	7	20	1	2	10	3	
	40-60	13	27	6	3	12	4	
	60-80	8	26	3	2	8	1	
	80-100	4	0	0	0	5	3	
Sex	Male	24	62	8	6	27	8	0.99
	Female	9	19	2	2	10	3	
BMI	Low	3	16	2	0	4	0	0.24
	Normal	30	65	6	8	33	11	
Smoking	Present	21	49	4	2	12	2	0.004
	Absent	12	32	6	6	25	9	

DISCUSSION

This study examined the demographic and clinical characteristics of patients with pulmonary and extrapulmonary tuberculosis, highlighting important differences in presentation, distribution, and associated risk factors. The mean age of participants was approximately 50 years, with the highest prevalence observed in the 40–60-year age group. This aligns with previous reports indicating that TB commonly affects individuals in their productive age (72.2 % in 20-60 years) , contributing significantly to socioeconomic burden (7). The predominance of male patients in our cohort also mirrors findings from other epidemiological studies, where social exposure, occupational risk, and behavioral factors such as smoking are more common among men (8).

Night sweats, malaise, fever, and cough were the most common symptoms across the cohort, with statistically significant differences observed in systemic and neurological manifestations among extrapulmonary cases. Extrapulmonary TB in this study presented with features such as confusion, neck stiffness, headache, abdominal pain, and diarrhea, which were absent in pulmonary cases. These findings reinforce the clinical heterogeneity of extrapulmonary TB and highlight the diagnostic challenges it poses. Similar patterns have been documented in studies where EPTB frequently mimics other systemic illnesses, resulting in delayed recognition and treatment (9,10).

The subtype distribution of extrapulmonary TB in our cohort showed pleural involvement as the most common form, followed by abdominal, central nervous system, and disseminated TB. This is consistent with global and regional literature, where pleural TB is frequently reported in hospitalized patients as the leading extrapulmonary manifestation (11–13). However overall, tuberculous lymphadenitis is the predominant form of extrapulmonary tuberculosis (outpatient setting) globally (14). Notably, smoking was found to be significantly associated with pulmonary TB in our study, underscoring its role as an established risk factor for lung disease. This association has been explained by the detrimental impact of smoking on local pulmonary immunity, which facilitates mycobacterial infection and progression (15).

From a theoretical standpoint, our findings can be interpreted within the host–pathogen interaction framework, where immune competence, environmental exposure, and lifestyle factors jointly influence disease localization (16). Younger age groups in our study demonstrated higher frequencies of extrapulmonary TB, particularly central nervous system involvement, suggesting that immune development and host susceptibility play a role in disease expression (17). Conversely, older age groups were more likely to present with pleural and disseminated forms, possibly reflecting immunosenescence and cumulative exposure risks (18). The clinical implications of these findings are significant. Recognizing that systemic and atypical symptoms are more often associated with extrapulmonary TB can guide clinicians toward early diagnostic consideration, especially in high-burden settings. Additionally, the strong association of smoking with pulmonary TB highlights the need for integrated public health measures addressing modifiable risk factors in TB control programs (19).

This study has some limitations. Being cross-sectional, it cannot establish causal relationships between risk factors and TB type. Diagnostic confirmation of extrapulmonary TB was partly reliant on clinical judgment and treatment response, which may introduce classification bias. The sample was limited to a single center, which could affect generalizability. Despite these limitations, the study provides valuable insights into the clinical spectrum of TB, emphasizing the importance of tailored diagnostic and management strategies.

CONCLUSION

This study highlights important demographic and clinical differences between pulmonary and extrapulmonary tuberculosis. Pulmonary TB was more strongly associated with smoking and respiratory symptoms, while extrapulmonary TB was characterized by systemic, neurological, and gastrointestinal manifestations, with pleural involvement being the most common subtype. Younger patients were more likely to develop central nervous system TB, whereas older patients frequently presented with pleural and disseminated disease. These findings underscore the diverse clinical spectrum of TB and the need for heightened clinical suspicion, particularly in patients with atypical presentations. Future studies should explore larger, multicenter cohorts to validate these findings and to assess the impact of comorbidities and immunological factors on disease localization. Longitudinal research is also warranted to better understand causal associations and outcomes across different forms of TB. By addressing these gaps, more effective, patient-centered strategies for TB prevention, diagnosis, and management can be developed.

Conflict of Interest

The authors declare no conflict of interest.

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