Correspondence
✉ Subhan Tahir, subhantahir024@gmail.com

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Prevalence of Tuberculosis, a Retrospective Review from Findings of Tertiary Care Hospitals Multan Pakistan

Samina Alia[1], Parveen kosur[2], Naila khalid[3], Ahmad Masood[1], Hamza Qasim[1]

[1] Kamyab Institute of Medical Sciences College of Nursing, Kot Addu, Pakistan
[2] DHQ Hospital, Kot Addu, Pakistan
[3] Kamyab Institute Of Medical Sciences College of Nursing, Wah Cantt, Pakistan

ABSTRACT

Background: Tuberculosis (TB) remains a major public health challenge in Pakistan, with substantial regional variability in facility burden and diagnostic yield. Facility-based evidence from South Punjab is needed to inform targeted TB control strategies. Objective: To describe the facility-based diagnostic yield among presumptive TB patients tested and the demographic and diagnostic-category distribution of TB cases registered at a tertiary-care TB unit in Multan, Pakistan (2023–2024). Methods: A retrospective facility-based record review was conducted at the TB Unit, Nishtar Hospital Multan, from January 2023 to December 2024. Routine program records were used to quantify outpatient screening, presumptive identification, testing volume, bacteriological confirmation yield, and registered TB case distribution by age, sex, and diagnostic category (PBC, PCD, EPBC, EPCD). Proportions with 95% confidence intervals were computed, and chi-square tests assessed sex-based distribution differences. Results: Among 103,109 OPD attendees, 2,882 presumptive TB patients were identified and 2,644 were tested; 173 were bacteriologically confirmed, yielding 6.54% positivity (95% CI 5.66–7.55). A total of 428 TB cases were registered, with males comprising 54.9% and females 45.1%. The highest case concentration occurred in ages 15–24 years (26.2%), with significant sex-by-age distribution differences (p=0.001). Extrapulmonary clinically diagnosed TB predominated (50.7%), with no sex difference in category distribution (p=0.807). Conclusion: TB case notification burden and diagnostic yield remain substantial in this tertiary-care facility, with young adult concentration and high extrapulmonary clinical diagnosis, supporting strengthened diagnostic pathways and targeted interventions.

Keywords

Tuberculosis; Retrospective review; Facility-based; Pakistan; Diagnostic yield; Extrapulmonary tuberculosis; GeneXpert.

INTRODUCTION

Tuberculosis (TB), caused by Mycobacterium tuberculosis, remains one of the most persistent infectious causes of morbidity and mortality worldwide and continues to pose a major public health challenge in low- and middle-income countries (1). Globally, the burden remains substantial, with the World Health Organization (WHO) reporting approximately 10.6 million people developing active TB in 2023, including a disproportionate burden among men, followed by women and children (2). Pakistan is consistently ranked among the world's highest TB-burden countries and remains a critical contributor to the global TB epidemic, reporting a high number of incident infections annually and facing additional complexity due to drug-resistant TB, particularly multidrug-resistant or rifampicin-resistant TB (MDR/RR-TB) (3). In high-burden settings, TB transmission and clinical outcomes are shaped by structural and biological determinants including poverty, delayed access to healthcare, malnutrition, diabetes mellitus, overcrowding, and occupational exposure, all of which influence infection risk, disease progression, diagnostic delays, and treatment success (4,6).

In Pakistan, TB epidemiology varies substantially by region, healthcare access, and diagnostic capacity, resulting in heterogeneous detection rates and differences in pulmonary versus extrapulmonary disease patterns (4). Facility-based studies are particularly valuable in such settings because they provide pragmatic evidence regarding case profiles, diagnostic yields, and demographic distributions among individuals who access care, thereby informing local TB control strategies and supporting targeted interventions at the health-system level (4). Moreover, disruptions associated with the COVID-19 period have altered healthcare-seeking behavior and TB program performance in many regions, reinforcing the need for updated, post-pandemic facility-level TB evidence in high-burden areas (4). South Punjab, including Multan Division, serves a large and diverse population with both rural and urban catchment characteristics; however, recent facility-based analyses describing TB case patterns and diagnostic yields from major tertiary-care TB units remain limited.

Comorbidity with diabetes mellitus represents an increasingly important risk factor and programmatic challenge, as diabetes is associated with a higher likelihood of progression from latent TB infection to active disease and is linked with worse TB treatment outcomes, including delayed sputum conversion and increased relapse risk (7,8). Similarly, undernutrition has been consistently associated with increased TB susceptibility and adverse clinical outcomes, creating a bidirectional relationship between TB and nutritional status in resource-limited settings (6). In parallel, diagnostic strategies have evolved, with microscopy remaining widely used for rapid detection of acid-fast bacilli, while molecular tools such as Xpert MTB/RIF have improved diagnostic yield and strengthened detection of rifampicin resistance; however, surveillance estimates based on routine program data may still be influenced by variability in access, testing patterns, and referral bias across settings (9).

Given these considerations, a retrospective facility-based review of TB cases from a major tertiary hospital TB unit in Multan can provide regionally relevant evidence on TB case distribution across age and sex strata, pulmonary versus extrapulmonary case patterns, and the yield of

presumptive testing within routine program workflows. Therefore, this study aimed to describe the facility-based TB case profile and notification patterns among patients evaluated and registered at Nishtar Hospital, Multan, Pakistan, during January 2023 to December 2024, and to quantify diagnostic yield among presumptive TB patients tested within routine program operations (4,10). The primary research question was: Among patients assessed and registered at the TB unit of a tertiary-care hospital in Multan (2023–2024), what were the facility-based TB diagnostic yield and the distribution of TB categories by age and sex? (4,10).

MATERIALS AND METHODS

A retrospective facility-based record review was conducted at the Tuberculosis (TB) Unit of Nishtar Hospital, Multan, a leading tertiary-care referral hospital in South Punjab, Pakistan, where a structured TB control program operates under routine clinical and programmatic care. The study period covered January 1, 2023, to December 31, 2024. The study utilized secondary data extracted from TB program registers and relevant diagnostic records maintained by the TB unit and affiliated pathology services, including OPD screening logs, presumptive TB registers, smear microscopy records, and GeneXpert/Xpert MTB/RIF testing logs, consistent with routine case notification reporting practices (10).

The study population included two overlapping datasets derived from routine program operations. First, presumptive TB patients identified in the outpatient workflow during the reporting period were included to estimate the diagnostic yield among tested presumptives. Second, all TB cases registered at the TB unit during the period were included to describe the distribution of TB categories and demographic patterns. Records were included if they contained complete entries for core variables (age, sex, diagnostic category, and case registration status). Records with missing or incomplete core variables were excluded from analysis to minimize misclassification and ensure accurate stratified reporting. No direct patient contact occurred, and no additional diagnostic testing was performed for research purposes.

Presumptive TB was defined as patients clinically identified by treating physicians as suspected TB cases based on symptoms, risk factors, and/or clinical evaluation and subsequently referred for diagnostic testing under routine TB program procedures (10). Diagnostic approaches included sputum smear microscopy using Ziehl–Neelsen staining for acid-fast bacilli (AFB), and molecular diagnosis via Xpert MTB/RIF for the detection of Mycobacterium tuberculosis complex and rifampicin resistance, which is aligned with global recommendations for rapid molecular diagnosis and drug resistance screening in high-burden settings (4,9). For laboratory sampling, specimens meeting routine operational requirements(10).

TB case categorization was extracted from program registers using standardized operational groupings used in the TB unit: pulmonary bacteriologically confirmed (PBC), pulmonary clinically diagnosed (PCD), extrapulmonary bacteriologically confirmed (EPBC), and extrapulmonary clinically diagnosed (EPCD). The dataset also included registration status categorized as new cases and recurrent cases, consistent with routine TB program case notification definitions (10). Age was categorized into programmatic bands: 0–4 years, 5–14 years, and then 10-year intervals from 15–24 years up to 55–64 years, with ≥65 years as the final category. The primary outcomes were (i) facility-based TB diagnostic yield among presumptive TB patients tested (bacteriologically confirmed cases among those tested), and (ii) distribution of registered TB cases across demographic strata (age group, sex) and disease categories (PBC/PCD/EPBC/EPCD). Statistical analyses were performed using descriptive methods, reporting counts and proportions with 95% confidence intervals (CIs) for key proportions. Pearson's chi-square test was applied to assess associations between sex and age-group distribution and between sex and TB diagnostic category distribution among registered cases. Two-tailed p-values <0.05 were considered statistically significant. The study reports facility-based proportions and does not attempt population-level prevalence estimation due to the absence of a defined catchment population denominator (4,10).

RESULTS

During January 2023 to December 2024, a total of 103,109 outpatient attendees were assessed within the reporting workflow. Among these, 2,882 (2.80%) were classified as presumptive TB and referred for diagnostic evaluation, of whom 2,644 (91.7%) underwent testing through routine diagnostic procedures.

Table 1. Facility workflow and diagnostic yield among presumptive TB patients (2023–2024)

Indicator	Count	Proportion (%, 95% CI)
New OPD attendees assessed during reporting period	103,109	—
Presumptive TB patients identified	2,882	2.80% of OPD
Presumptive TB patients tested	2,644	91.7% of presumptives
Bacteriologically confirmed TB among tested presumptives	173	6.54% (95% CI 5.66–7.55)
Total TB cases registered at TB unit (all categories)	428	0.42% of OPD (95% CI 0.38–0.46)

Table 2. Age- and sex-specific distribution of registered TB cases (N = 428)

Age group (years)	Male n (%)	Female n (%)	Total n (%)
0–4	11 (4.7)	2 (1.0)	13 (3.0)
5–14	27 (11.5)	20 (10.4)	47 (11.0)
15–24	43 (18.3)	69 (35.8)	112 (26.2)
25–34	34 (14.5)	27 (14.0)	61 (14.3)
35–44	44 (18.7)	29 (15.0)	73 (17.1)
45–54	31 (13.2)	25 (13.0)	56 (13.1)
55–64	19 (8.1)	12 (6.2)	31 (7.2)
≥65	26 (11.1)	9 (4.7)	35 (8.2)
Total	235 (54.9)	193 (45.1)	428 (100)

Among tested presumptives, 173 cases were bacteriologically confirmed, corresponding to a diagnostic yield of 6.54% (95% CI 5.66–7.55). Across the same period, 428 TB cases were registered at the TB unit across pulmonary and extrapulmonary diagnostic categories, representing 0.42% (95% CI 0.38–0.46) of all OPD attendees evaluated within the facility workflow. These measures represent facility-based proportions derived from routine program operations and should not be interpreted as population prevalence. Among the 428 registered TB cases, 235 (54.9%) were male and 193 (45.1%) were female, yielding a male-to-female ratio of approximately 1.22:1. TB cases were distributed across the lifespan, ranging from early childhood to ≥65 years, with the highest burden concentrated in young adults aged 15–24 years (112/428, 26.2%). This peak was driven by a comparatively high number of female cases in this group (69/193, 35.8% of all female TB cases), whereas males in the same age band comprised 43/235 (18.3%) of male TB cases. The second-highest burden was observed in 35–44 years (73/428, 17.1%), followed by 25–34 years (61/428, 14.3%) and 45–54 years (56/428, 13.1%). The age distribution differed significantly by sex (p = 0.001), indicating that the pattern of TB registration across age strata was not uniform between males and females in this facility cohort.

Table 3. Diagnostic category distribution of registered TB cases by sex (N = 428)

TB category	Male n (%)	Female n (%)	Total n (%)
Pulmonary bacteriologically confirmed (PBC)	60 (25.5)	47 (24.4)	107 (25.0)
Pulmonary clinically diagnosed (PCD)	55 (23.4)	48 (24.9)	103 (24.1)
Extrapulmonary bacteriologically confirmed (EPBC)	1 (0.4)	0 (0.0)	1 (0.2)
Extrapulmonary clinically diagnosed (EPCD)	119 (50.6)	98 (50.8)	217 (50.7)
Total	235 (100)	193 (100)	428 (100)

Chi-square test (sex × TB category): $\chi^2(3) = 0.98$, p = 0.807

Across registered TB cases, extrapulmonary clinically diagnosed TB (EPCD) constituted the largest category, accounting for 217/428 (50.7%) of all TB registrations, and was similarly distributed in males (119/235, 50.6%) and females (98/193, 50.8%). Pulmonary bacteriologically confirmed TB accounted for 107/428 (25.0%), while pulmonary clinically diagnosed TB accounted for 103/428 (24.1%). Extrapulmonary bacteriologically confirmed TB was rare (1/428, 0.2%) within the facility dataset. The category distribution did not significantly differ by sex (p = 0.807), suggesting that although males had a higher overall number of registered cases, the proportional breakdown by diagnostic category was comparable between males and females.

Table 4. TB registration status during the study period (N = 428)

Registration status	PBC	PCD	EPBC	EPCD	Total n (%)
New cases	101	101	1	216	419 (97.9)
Recurrent cases	6	2	0	1	9 (2.1)
Previously treated (excluded recurrent)	0	0	0	0	0 (0.0)
Total	107	103	1	217	428 (100)

The overwhelming majority of TB registrations during January 2023 to December 2024 were new cases (419/428, 97.9%), while recurrent cases accounted for 9/428 (2.1%). New registrations contributed most of the burden across all diagnostic categories, including 101 of 107 (94.4%) pulmonary bacteriologically confirmed cases and 216 of 217 (99.5%) extrapulmonary clinically diagnosed cases. Recurrent registrations were uncommon but present across pulmonary categories, with 6 recurrent PBC cases and 2 recurrent PCD cases, indicating ongoing recurrence within a small subset of patients presenting to the facility TB unit.
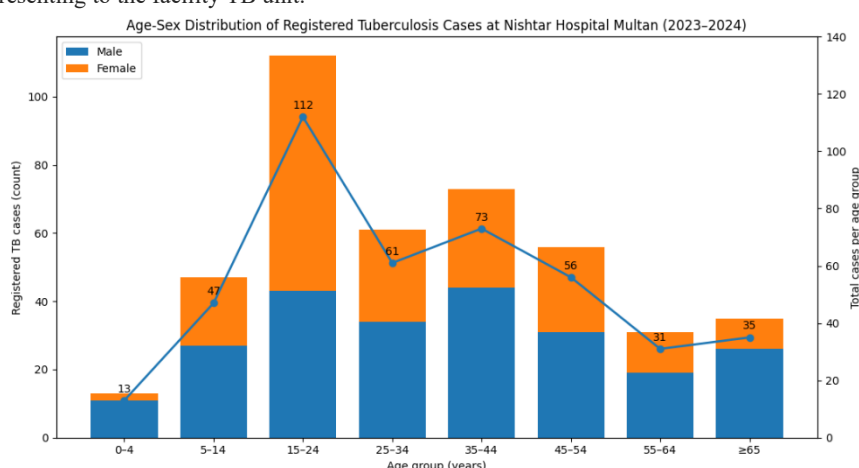

Figure 1 Age-Sex Distribution of Registered Tuberculosis Cases at Nishtar Hospital Multan

The figure demonstrates a pronounced concentration of registered TB cases in the 15–24-year age group (112/428, 26.2%), with a marked female predominance (69 females vs 43 males), producing the highest total case peak across all age strata. A secondary burden cluster is observed in 35–44 years (73/428, 17.1%) followed by 25–34 years (61/428, 14.3%) and 45–54 years (56/428, 13.1%), reflecting sustained case registration across the adult working-age population. In contrast, childhood TB registrations remain comparatively low, with 0–4 years accounting for 13/428 (3.0%), while older age categories contribute modest but relevant case loads, including ≥65 years (35/428, 8.2%), where males contribute the majority (26/35, 74.3%). Overall, the visualization highlights a clinically important age–sex gradient in facility TB registrations, suggesting that young

adult females and middle-aged adults represent priority strata for optimized screening, referral, and diagnostic confirmation strategies within tertiary-care TB program workflows.

DISCUSSION

This retrospective facility-based record review from a tertiary-care TB unit in Multan provides updated programmatic evidence on TB diagnostic yield among tested presumptive patients and the demographic and clinical distribution of registered TB cases during 2023–2024. The diagnostic yield among tested presumptives was 6.54% (173/2644), while 428 TB cases were registered during the study period, reflecting routine case notification workload within a high-burden setting. These findings reinforce the continuing burden of TB in Pakistan and the need for sustained diagnostic and treatment capacity at major referral facilities, particularly in regions such as South Punjab where patient inflow includes both urban and peri-urban populations and substantial referral traffic from surrounding districts (4,10). Importantly, the study reports facility-based indicators and should not be interpreted as population-level prevalence, which requires a defined catchment denominator and community-based sampling (4,9).

A key observation in this cohort was the concentration of registered TB cases in younger adults, with the 15–24-year age group contributing 26.2% of all registered cases and demonstrating a marked female predominance within that stratum. This pattern aligns with the known epidemiologic feature that TB disproportionately affects economically productive age groups, with high societal costs related to lost productivity, delayed healthcare access, and treatment interruptions (4). The statistically significant association between sex and age distribution suggests that TB case profiles at the facility level may reflect sex-specific health-seeking behavior, exposure patterns, and referral pathways. While global TB burden typically shows higher case counts among men, localized facility-based distributions can differ depending on the diagnostic strategies and clinical thresholds for evaluation, as well as on sociocultural determinants influencing access to care (2,4). The female predominance in the 15–24 group within this dataset should therefore be interpreted as a signal for targeted qualitative and programmatic inquiry, including assessment of pregnancy-related healthcare encounters, family screening practices, and potential clustering of household exposure among young women.

The distribution of TB diagnostic categories was notable for the predominance of extrapulmonary clinically diagnosed TB (50.7%), with pulmonary bacteriologically confirmed (25.0%) and pulmonary clinically diagnosed TB (24.1%) comprising most of the remainder. Although extrapulmonary TB is common in many settings, the high proportion of clinically diagnosed extrapulmonary cases may also indicate limited bacteriological confirmation capacity for extrapulmonary disease due to specimen accessibility constraints and operational limitations inherent to routine services (4,9). This profile underscores the need for strengthening diagnostic pathways for extrapulmonary TB, including improved specimen collection methods, histopathology integration where available, and optimized access to molecular testing for non-sputum samples, consistent with international guidance advocating rapid diagnostics and improved confirmation of TB across disease sites (4,9). The absence of a significant sex difference in TB category distribution suggests that once patients reached the TB unit, diagnostic classification patterns were broadly comparable between males and females, supporting the consistency of the facility's diagnostic approach across sexes.

The study also documented that nearly all registered cases were new episodes (97.9%), with recurrent cases forming a small proportion (2.1%). While this may reflect the true episode distribution among TB patients presenting to the facility, it may also relate to referral and follow-up patterns, with recurrent disease potentially managed at peripheral centers or underreported if documentation is incomplete across care transitions (10). Nonetheless, the presence of recurrent cases emphasizes the ongoing importance of adherence support, continuity of care, and identification of treatment failure or drug resistance where clinically indicated. As Pakistan remains among countries burdened by drug-resistant TB, strengthening the linkage between routine clinical follow-up and diagnostic escalation for non-responders remains essential (3,4). Additionally, comorbid diabetes mellitus and undernutrition remain critical determinants of TB risk and outcomes, and facility TB units in high-burden settings may benefit from integrated screening and management pathways for these conditions to improve treatment outcomes and reduce recurrence risk (6–8).

This study has several strengths, including the use of real-world programmatic data across a two-year period, standardized case categorizations, and structured reporting of diagnostic yield and category distributions. However, limitations should be acknowledged. As a facility-based record review, the findings are subject to referral bias and may over-represent complicated cases and extrapulmonary disease. The study does not quantify community incidence or prevalence, nor does it include detailed comorbidity profiles, socioeconomic indicators, radiologic findings, or longitudinal outcomes such as treatment success rates. Additionally, clinically diagnosed TB categories may vary in diagnostic certainty depending on documentation and availability of confirmatory testing. Despite these limitations, the study provides valuable local evidence for strengthening TB diagnostic strategies, supporting targeted interventions for high-burden age groups, and improving extrapulmonary TB confirmation capacity under routine program conditions (4,9,10).

CONCLUSION

This retrospective facility-based review from a tertiary-care TB unit in Multan demonstrates a sustained diagnostic and case notification burden during 2023–2024, with a measurable diagnostic yield among tested presumptive patients and a registered case profile dominated by young adults and clinically diagnosed extrapulmonary disease. The significant sex-by-age distribution, particularly the concentration of cases in the 15–24-year group, highlights the need for age-responsive and sex-sensitive screening, outreach, and linkage-to-care strategies, while the high proportion of extrapulmonary clinically diagnosed TB supports strengthening bacteriological confirmation pathways and optimizing access to molecular diagnostics within routine services. Collectively, these findings can inform regional TB control planning and reinforce the need for sustained diagnostic capacity, integrated management of key risk factors such as diabetes and undernutrition, and enhanced program follow-up to reduce recurrence and improve outcomes in high-burden settings.

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