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Prevalence of Tuberculosis Trends in District Abbottabad, Pakistan: A Cross-Sectional Survey

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ABSTRACT

Tuberculosis (TB) remains a major public health concern in Pakistan, with the country ranked sixth among high-burden developing nations. Significant regional disparities in TB incidence emphasize the importance of localized surveillance and targeted interventions. **Objectives:** To assess the prevalence of TB in District Abbottabad, explore variations by age and gender, and evaluate trends in TB cases reported by healthcare facilities between January 2022 and December 2023. **Methods:** A retrospective cross-sectional study was conducted from April to October 2024, utilizing secondary data from the TB Control Programme, Khyber Pakhtunkhwa. Purposive sampling included all registered pulmonary tuberculosis patients with positive sputum smear results (PTBSS). Data were entered into Microsoft Excel and analyzed using frequency distributions, histograms, and bar charts to highlight case patterns and temporal trends. **Results:** In 2022, 810 new bacteriologically confirmed TB cases were reported in Abbottabad, increasing to 843 in 2023, representing a 4% rise. Male patients were more frequently affected, with male-to-female ratios of 1.07 and 1.17 in 2022 and 2023, respectively. The PPM ACD center reported the largest share of cases. Moreover, relapsed pulmonary TB cases rose from 78 to 96 between the two years, showing a 23% increase. The overall relapse rate (23%) was higher than the 11.2% previously reported from Pakistan. **Conclusion:** District Abbottabad demonstrates a persistent TB burden with a notable 23% rise in relapse cases, indicating gaps in treatment outcomes. Strengthening follow-up, improving adherence, and enhancing case detection in high-risk groups remain crucial for effective TB control.

INTRODUCTION

Tuberculosis (TB), caused by the acid-fast bacillus Mycobacterium tuberculosis (MTB), is a widespread infectious disease affecting all countries and age groups. Robert Koch first identified Mycobacterium tuberculosis, also known as the tubercle bacillus, as the causative agent of TB in 1882 [1]. While the disease primarily affects the lungs (pulmonary TB), it can also involve other organs if left untreated (extrapulmonary TB). Common symptoms include chronic cough (occasionally with blood), fatigue, weight loss, chest pain, night sweats, and shortness of breath [2]. TB continues to be one of the most significant public health challenges globally. It was among the leading causes of death in 2019 and 2023, ranking as the second deadliest infectious disease after COVID-19, especially in low- and middle-income countries [3]. In 2016, TB was the leading cause of death from a single infectious agent and remains highly endemic in Pakistan [4]. Despite being preventable and treatable, TB claimed 1.6 million lives globally in 2021, including 187,000 deaths among HIV-positive individuals. That same year, an estimated 10.6 million people developed TB worldwide [5]. In recognition of its widespread impact, the World Health Organization

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(WHO) declared TB a global emergency in 1993 [5]. In 2022, the World Health Organization (WHO) reported that the South-East Asian Region accounted for the largest share of global tuberculosis (TB) cases (46%), followed by the African Region (23%) and the Western Pacific Region (18%). Nearly 87% of all new TB cases were concentrated in 30 high-burden countries, with Pakistan, Bangladesh, China, the Democratic Republic of the Congo, India, Indonesia, Nigeria, and the Philippines collectively representing over two-thirds of the worldwide TB burden [6]. Pakistan is among the high-burden countries for TB, with a national prevalence rate of approximately 5% [6]. The country ranks sixth in TB burden among developing nations [7], and a significant gap exists between the estimated incidence and the number of reported cases—approximately 241,688 cases go unreported each year [8]. In the province of Khyber Pakhtunkhwa (KPK) alone, around 5,10,000 new TB cases are reported annually, highlighting its persistent public health impact [7]. A key obstacle in TB control efforts is the emergence of drug resistance, especially multidrug-resistant TB (MDR-TB). Despite advancements in diagnostic tools, sputum smear microscopy remains the most widely used method, though it lacks effectiveness in detecting drug resistance [9]. According to WHO data, there were 10.4 million new TB cases globally, of which 490,000 were multidrug-resistant, and 110,000 were rifampicin-resistant [10]. To address these challenges, Pakistan's National Tuberculosis Control Program (NTP), with support from WHO, implements diagnostic measures including sputum smear microscopy and chest radiography. Patients with at least two sputum samples positive for acid-fast bacilli (AFB) or one positive sample accompanied by radiographic signs of active pulmonary TB are classified as sputum smear-positive (SS+) cases [9, 11]. Furthermore, WHO has advocated the Public–Private Mix (PPM) strategy to enhance TB detection and treatment in high-burden countries. Under this approach, the NTP collaborates with private healthcare providers to bridge the gap between estimated and reported cases [8]. Recent trends from South Asia during 2022–2023 show progress in TB control despite disruptions caused by the COVID-19 pandemic. Pulmonary TB (PTB) epidemiology is shaped by factors such as age, sex, geographic location, immunity, drug resistance, and HIV status. In Pakistan, regional disparities in TB incidence and prevalence persist, necessitating targeted and localized interventions [12]. Concurrently conducting a survey that gauges a population-level indicator of M. tuberculosis transmission, such as risk of M. tuberculosis infection, is necessary to support the interpretation of changes in the prevalence of adult pulmonary disease. However, in the past few decades, these have hardly ever been carried out simultaneously to evaluate load [13]. By identifying and connecting individuals afflicted with tuberculosis, Active case finding (ACF) is one intervention that may help prevent the spread of M. tuberculosis. However, the efficacy of ACF at the population level is still unknown, and these efforts require a lot of resources [14].

A comprehensive search was conducted using PubMed, Google Scholar, and other search engines; however, no studies were found reporting the incidence or prevalence of tuberculosis (TB) in Abbottabad. Therefore, this study was undertaken to fill this gap in the existing literature. By analysing data from 2022 to 2023, this research seeks to understand the local epidemiology of TB, including its distribution by age, gender, and healthcare facility, to inform more effective control and prevention strategies. This study aimed to investigate the trends and patterns of TB prevalence in Abbottabad, a district in Khyber Pakhtunkhwa, Pakistan.

METHODS

This retrospective cross-sectional study was conducted using data from the TB Control Program, Khyber Pakhtunkhwa, recorded between January 1, 2022, and December 31, 2023. Ethical approval for the study was obtained from the Institutional Review Board of Women's Medical College (Ref. No. WMC/Re/IRB//07). The sample included 2,503 patients from 2022 and 2,840 patients from 2023, reported from all tuberculosis centers in District Abbottabad, namely Ayub Teaching Hospital Abbottabad, Civil Hospital Boi, Civil Hospital Nathia Gali, Civil Hospital Sherwan, DTO Clinic, PPM ACD, RHC Havelian, RHC Lora, and the TB Association. The study was carried out over six months from April to October, 2024. Purposive sampling was used to select study participants. The study included all patients with pulmonary tuberculosis who were bacteriologically confirmed through sputum smear positivity and who attended the treatment centers between January 2022 and December 2023. A total of 810 patients from 2022 and 843 patients from 2023 meeting these criteria were included in the analysis. Patients with extrapulmonary tuberculosis or those clinically diagnosed but not bacteriologically confirmed were excluded. Data regarding age, gender, diagnostic method, and facility-wise distribution of TB cases were retrieved from TB07 forms maintained by the TB Control Program, Khyber Pakhtunkhwa. The collected data were entered and analyzed using Microsoft Excel, and the results were presented in the form of tables and graphs. Categorical variables were summarized as frequencies and percentages.

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RESULTS

Data for newly diagnosed bacteriologically confirmed TB cases registered were recorded from seven tuberculosis centers in District Abbottabad for the years 2022 and 2023. During this period, 810 and 843 cases were reported for the years 2022 and 2023, respectively. An overall increase of 4% in new TB cases was observed between the two years. Moreover, the data for relapsed cases of pulmonary tuberculosis recorded from the same centers and dates showed 78 and 96 cases for the years 2022 and 2023, respectively. Thus, an overall increase of 23% was observed in relapsed TB cases between the two years. In 2022, a slightly higher number of cases were reported among males compared to females (447 vs. 441), resulting in a male-to-female ratio of 1.07. This male predominance continued in 2023, with 508 cases in males and 431 in females, reflecting a male-to-female ratio of 1.17. Across all health facilities, males constituted 54.1% of TB cases, while females accounted for 45.9%. Age-wise analysis revealed that the highest number of TB cases in both years occurred in the age group 65 years and older, with 102 cases in 2022 and 114 cases in 2023. The age group over 65 years represented the largest proportion of TB cases (21.9%), followed by the 15–24 years group (19.9%) and the 55–64 years group (15.7%) (Table 1).

Table 1: Association of Pulmonary Tuberculosis with Gender and Different Age Groups

Variables	TB Cases 2022, n (%)	TB Cases 2023, n (%)
Gender		
Male	447 (50.34%)	508 (54.1%)
Female	441 (49.67%)	431 (45.90%)
Age Group		
0-4 Years	5 (0.56%)	8 (0.9%)
5-14	27 (3.04%)	29 (3.1%)
15-24	184 (20.7%)	187 (19.9%)
25-34	114 (12.8%)	140 (14.9%)
35-44	115 (12.9%)	122 (12.9%)
45-54	110 (12.4%)	100 (10.6%)
55-64	124 (13.9%)	147 (15.7%)
>65	209 (23.5%)	206 (21.9%)
Treatment History		
New Cases	810 (91.2%)	843 (89.8%)
Reveals a 4% Increase Per the Formula: 943-910/910 × 100 = 4.07%		
Relapse Cases	78 (8.8%)	96 (10.2%)
Reveals a 23% Increase Per the Formula: 96-78/78 × 100 = 23.08%		

Analysis by the healthcare facility showed that the highest TB prevalence was observed at the PPM ACD center, accounting for 32.7% of cases in 2022 and increasing to 36.8% in 2023. This was followed by Ayub Teaching Hospital, which reported 28.7% of cases in 2022 and 19.8% in 2023 (Table 2).

Table 2: Tuberculosis Health Care Facilities in Abbottabad

Health Care Facility	TB Cases 2022, n (%)	TB Cases 2023, n (%)
Ayub Teaching Hospital	255 (28.7%)	186 (19.8%)
Civil Hospital Boi	15 (1.7%)	10 (1.1%)
Civil Hospital Nathiagali	20 (2.3%)	20 (2.1%)
Civil Hospital Sherwan	07 (0.8%)	06 (0.6%)
DTO Clinic	223 (25.1%)	273 (29.1%)
PPM ACD	290 (32.7%)	34 (36.8%)
RHC Havelian	37 (4.2%)	51 (5.4%)
RHC Lora	31 (3.5%)	40 (4.3%)
TB Association Center	10 (1.1%)	07 (0.8%)
Abbottabad	888	939

DISCUSSION

Pakistan continues to face a high burden of tuberculosis, with significant prevalence, incidence, and mortality rates. The National TB Control Program is focused on increasing the notification of TB cases and improving treatment success rates. However, effective TB control requires accurate and detailed epidemiological data on TB prevalence and distribution. Our study showed an increasing trend of 4% in the prevalence of Tuberculosis over a period of two years. These findings are in contrast to a survey conducted in Karachi that showed a decrease in prevalence in the active microbiologically sputum-positive cases [15]. Another study in South Punjab showed that the incidence rate of Tuberculosis increased in almost all regions, with the Multan division exhibiting the highest incidence, followed by Bahawalpur and D. G Khan [16]. The rate of relapse cases of TB in our study was 23%, which is higher than the previous report (11.2%) from Pakistan published in 2022 [17]. Male were more affected than females in both years of our study period. which. is supported by another study in Bajaur agency, in which male was dominant [18]. Yet another research revealed that the prevalence of active TB was higher among women [19]. However, another research in Abbottabad and Mansehra districts showed that the number of TB cases reported was almost equal in male and female patients (M/F ratio 1.01) [20]. Yet another research showed that pulmonary tuberculosis was significantly more common in female patients than in male [21]. Age-wise, the highest number of TB cases in our study was observed in individuals over 65 years of age for both 2022 and 2023, followed by the 15–24 and 55–64-year age groups. However, our findings are somewhat aligned with the Bajaur study, which reported the highest TB positivity in the 11–20 and 21–30-year age groups [18]. These findings are similar to research that revealed that the median age of participants was 35 (IQR 13.8) and the age distribution was skewed towards older age groups [22]. Yet another study in Peshawar showed that Tuberculosis was more prevalent in people >45 years [23].

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Another research in urban Sindh highlighted that 19-45 years was the most common age group affected [24]. The elevated prevalence among older adults in our study may be due to immune-senescence and the presence of comorbidities, which increase the risk of latent TB reactivation. The 15–24 years age group, which ranked second (19.9%), highlights ongoing transmission in the younger population, possibly due to increased social contact, mobility, and poor health-seeking behaviour. The 55–64 years group (15.7%) also contributed significantly, reflecting the need for targeted TB screening in older adults. When analysing TB prevalence by healthcare facility, the Public-Private Mix Active Case Detection (PPM ACD) center emerged as the leading site for TB detection, accounting for an increasing proportion of diagnosed cases (from 32.7% in 2022 to 36.8% in 2023. This suggests the growing effectiveness or outreach of the PPM ACD program, potentially due to its active case-finding strategies and community engagement. In contrast, the proportion of cases reported by Ayub Teaching Hospital declined in 2023, which may reflect shifting patient preferences, referral patterns, or resource limitations in passive case detection centers. The majority of TB cases in both years were bacteriologically confirmed new cases, comprising over 89% of all cases. This high percentage indicates strong diagnostic capacity and a focus on identifying new infections. However, a noticeable increase in relapse cases—from 78 (8.8%) in 2022 to 96 (10.2%) in 2023 raises concerns about treatment adherence, drug resistance, or gaps in post-treatment follow-up. The rising trend in relapse cases underlines the importance of strengthening treatment monitoring, patient education, and support systems to ensure successful treatment outcomes. Together, these findings underscore the need for age-specific interventions, enhanced active case-finding programs like the PPM ACD, and robust post-treatment support to curb the spread and recurrence of TB. Regarding disease recurrence, the majority of cases in our study were newly diagnosed, with relapse cases accounting for 8.8% in 2022 and 10.2% in 2023. These rates are comparable to those reported in Punjab (9.9%) [16], Bahawalpur (11.4%) [18], and Rawalpindi (11.2%) [20]. However, our relapse rate is higher than that observed in a tertiary care center in Rawalpindi, where it was reported at 5.4% [21]. Overall, our findings highlight the continuing challenges in TB control in Pakistan, emphasizing the need for targeted interventions that consider gender disparities, age-related vulnerabilities, and the importance of monitoring relapse cases to improve disease management.

This study is limited by its reliance on routinely reported surveillance data, which may be affected by underreporting, reporting delays, and variability in diagnostic and recording practices across healthcare facilities. Additionally, the absence of individual-level data on socioeconomic status, comorbidities, and treatment adherence limits causal interpretation of observed trends and relapse patterns. Future studies should incorporate longitudinal, patient-level data and strengthen active case-finding and post-treatment follow-up to better understand drivers of TB prevalence and relapse in Pakistan.

CONCLUSIONS

The study revealed a 4% increase in TB cases in District Abbottabad from 2022 to 2023, with a higher prevalence among males and individuals aged over 65. Most cases were newly diagnosed, while relapse cases increased by 23% during the same period, reflecting potential challenges in treatment adherence and follow-up. The highest burden was reported at the PPM ACD center. These findings highlight the need for strengthened surveillance, targeted interventions for high-risk groups, and improved access to TB care services.

Authors' Contribution

Conceptualization: YI, SM
Methodology: YI, SM, MOM
Formal analysis: MOM, AT, UN, SR
Writing and drafting: MOM, AT, UN, SR
Review and editing: YI, SM, MOM, AT, UN, SR

All authors approved the final manuscript and take responsibility for the integrity of the work.

Conflicts of Interest

All the authors declare no conflict of interest.

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