

COMPREHENSIVE EPIDEMIOLOGICAL ANALYSIS OF TUBERCULOSIS BASED ON AGE, GENDER, AND CLINICAL FORM IN DISTRICT DERA ISMAIL KHAN

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Abstract

Material and Methods: This descriptive cross-sectional study was conducted at DHQ Hospital in Dera Ismail Khan from January 1, 2022 to December 31, 2023. A retrospective

Introduction: Tuberculosis (TB) remains a significant public health concern, particularly in developing countries such as Pakistan. Understanding the prevalence, demographic distribution, and kinds of tuberculosis is critical for optimal disease management. Investigating the prevalence and prognosis of tuberculosis patients at the District Head Quarter (DHQ) Hospital in Dera Ismail Khan, Khyber Pakhtunkhwa, Pakistan, is the aim of this study. examination of 5,246 probable tuberculosis cases was conducted. To identify tuberculosis-positive cases, sputum smear microscopy with Ziehl-Neelsen staining was used. Demographic information such as age, gender, TB type (pulmonary or extrapulmonary), and past history were gathered. Laboratory services and treatment techniques were in accordance with the National Tuberculosis Control Program (NTCP) guidelines.

Result: Among the 5,246 patients investigated, 38.52% tested positive for tuberculosis. The male-to-female ratio was 43.93% to 56.06%, with more patients recorded in 2023 than in 2022. Pulmonary tuberculosis was the most widespread, accounting for 77% of cases, followed by extra-pulmonary tuberculosis (23%). The incidence of pulmonary tuberculosis was highest (18.22%) in patients aged ≥65 years, followed by 15.11% in those aged 15-24

years. Other age groups were 12.42% in 55-64 years, 11.18% in 25-34 years, 8.70% in 45-54 years, 8.28% in 35-44 years, 3.11% in 5-14 years, and 0.83% in 0-4 years. Extra-pulmonary tuberculosis had the highest prevalence (4.55%) in the 15-24 and ≥ 65 age groups, followed by 3.73% in 55-64, 3.11% in 25-34, 2.48% in 45-54, 1.86% in 5-14, 1.24% in 35-44, and 0.62% in 0-4 years.

Conclusion: The study underscores the prevalence of pulmonary TB over extra-pulmonary TB in the elderly and young adult groups. The findings highlight the need of targeted TB control efforts, particularly in high-risk age groups, in reducing the disease burden and improving treatment outcomes in Dera Ismail Khan.

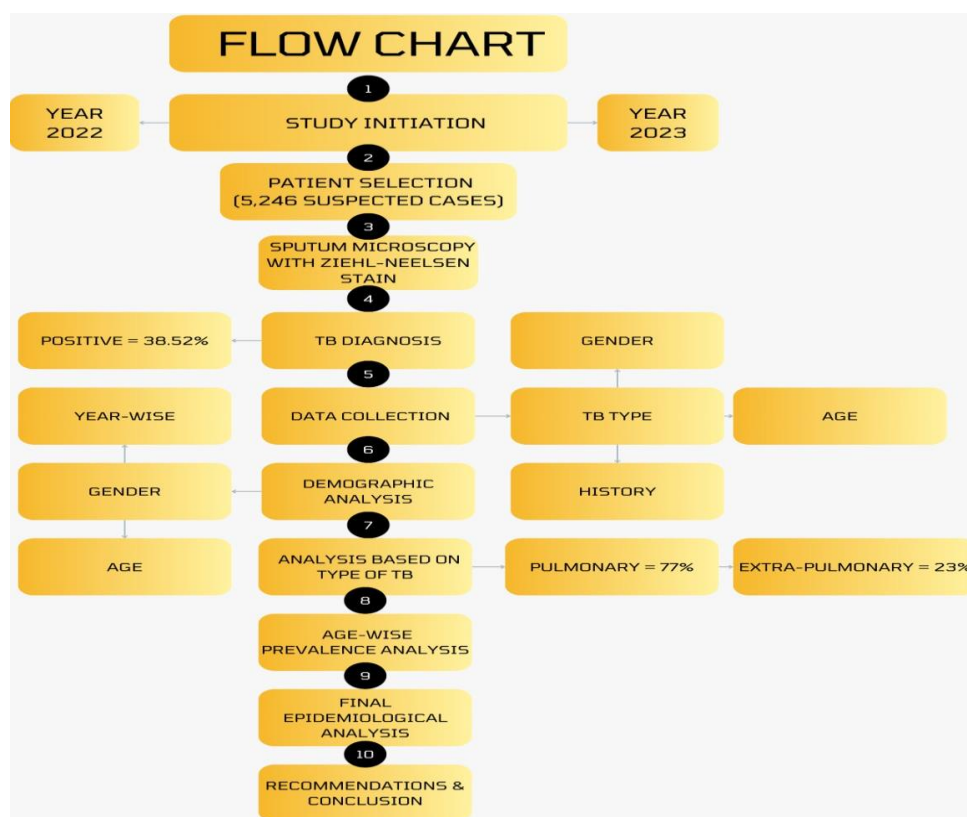


Figure:1 An overview of the epidemiology of tuberculosis in Dera Ismail Khan, Pakistan, from 2022 to 2023: Among 5,246 suspected cases, the graphical abstract shows the seroprevalence trends of tuberculosis by age group, gender distribution, and type (pulmonary vs. extra-pulmonary). According to the data, pulmonary tuberculosis (TB) is more common in women (77% of cases) and more commonly affects people aged 15–24 and ≥ 65 . These results highlight the necessity of gender- and age-focused TB control measures.

INTRODUCTION

Tuberculosis is a long-term infectious disease triggered by the bacteria *Mycobacterium tuberculosis* bacillus (Koch bacillus), which prefers lung parenchyma and transmits from person to person via the inhalation of microorganism-containing particles

(1). Infection with *Mycobacterium tuberculosis*, also known as tuberculosis, affects approximately one-third of the world's population (2). In 2009, over ten million new cases of TB were report. In the same year, TB killed more than a million HIV-negative

people (3). The greater part of new TB cases occur in developing nations, accounting for over 85% of all reported cases (3).

Tuberculosis alone accounts for more deaths in female of childbearing age than all-cause maternal mortality (4). In the past, with the development of HIV, there was a threefold raised in the occurrence of various kinds of tuberculosis in countries with a high HIV prevalence, but the incidence of tuberculosis has lately decreased, as report in 2009. Tuberculosis is accountable for 25% of mortality in HIV positive patients with AIDS, and in 2009, tuberculosis killed up to 0.4 million HIV positive persons worldwide. Individuals with HIV-positive disease and Mycobacterium TB infection are 20-30 times more likely to have active tuberculosis than HIV-negative patients.

The situation is aggravated by multidrug-resistant tuberculosis, or MDR. In 2009, there were approximately 0.5 million new cases of MDR worldwide (4). 27 countries account for 86% of global MDR TB cases, with Pakistan placing fourth among these high-burden nations (3). In a recent study conducted in Mumbai, MDR-TB patients and their family characterized the condition as the worst of the worst illnesses, with the sickness treatment being worse than the illness itself (5).

The WHO reports that individuals with tuberculosis and MDR-TB are becoming increasingly resistant to at least isoniazid and rifampicin each year, which is the primary obstacle to disease elimination. A recent meta-analysis of data from 25 nations found that MDR patients had a combined therapy success rate of only 61%, compared to 82% for drug-susceptible individuals. This is the primary explanation for the increase in MDR-TB cases. Khan and colleagues 2019a. According to the WHO, 9 million people globally had tuberculosis in 2013, with 1.5 million dying as a result.

All available anti-TB techniques have led in a 45% reduction in tuberculosis deaths since 1945; nonetheless, the illness has been managed utilizing programmatic, directly monitored therapeutic short courses strategies. MDR-TB is purely the result of

human error, which includes incorrect diagnosis, inefficient treatment, ignorance of the illness, failure to effectively care for TB patients, long wait times, and disobedience, particularly with regard to anti-TB medication side effects (6).

In 2010, 9.8 million incident cases were reported (128 cases per 100,000 people), with an additional 1.1 million HIV positive patients. In 2010, India reported the most incident instances (2.0-2.5 million), followed by China (0.9-1.2 million), South Africa (0.40-0.59 million), Indonesia (0.37-0.54 million), and Pakistan (0.33-0.48 million) (7). India and China account for 38% of all cases (26% from India and 12% from China). South Africa and Swaziland have the greatest incidence of tuberculosis, with one new case per 100 persons each year (8). In 2010, 59% of tuberculosis cases were reported in Asia, with 26% from Africa, 7% from the Eastern Mediterranean, 5% from Europe, and 3% from the Americas (7). In 2012, 58% of TB cases were reported in Asia, 27% in the African Region, 8% in the Eastern Mediterranean, 4% in Europe, and 3% in the Americas.

A 2017 study in Pakistan indicated that there were 27000 MDR-TB cases, with 4.2% being newly infected and 16% being those who had previously had TB treatment. The first National Drug Resistance Survey of Pakistan, finished in September 2013, discovered that the frequency of new cases of pulmonary tuberculosis was 3.7%, while the prevalence of retreatment patients was 18.1%. This implies that due to previous poor anti-TB therapy, a lack of patient adherence, and poor/inadequate TB drug quality in Pakistan, retreatment patients are more common than non-retreatment cases. According to the WHO in Pakistan, rather than starting them on a Category II regimen, patients who fail therapy, such as those in Category 1, should be tested for drug resistance (9).

Our current study's purpose is to investigate the prevalence and prognosis of tuberculosis patients at the Khyber Pakhtunkhwa Dera Ismail Khan District DHQ Hospital, DIK.

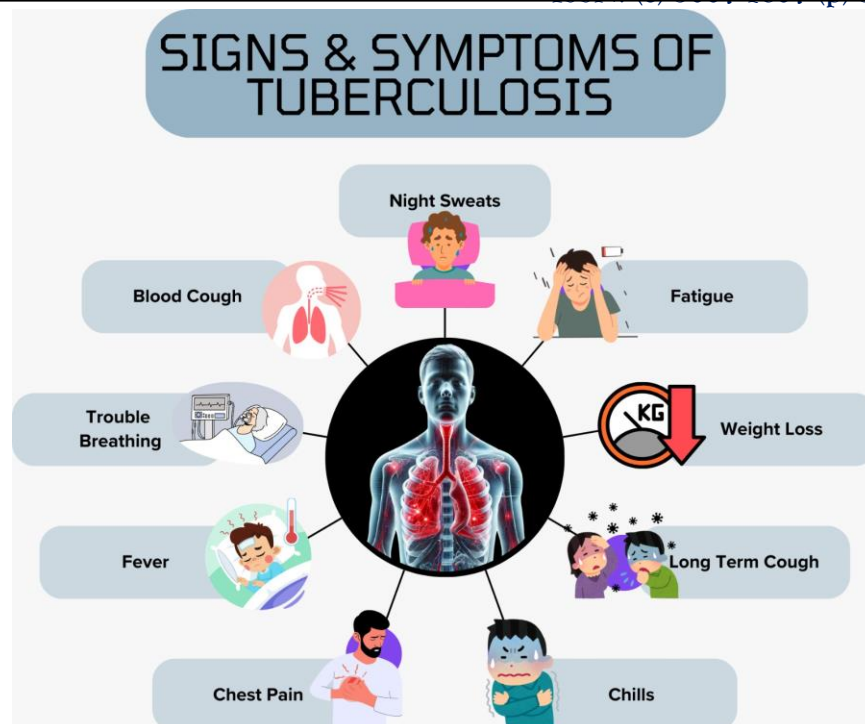


Figure: 2 Visual representation of the common signs and symptoms of tuberculosis (TB). These include night sweats, fatigue, significant weight loss, long-term cough, chills, chest pain, fever, trouble breathing, and coughing up blood. Recognizing these clinical features is essential for early detection, timely diagnosis, and appropriate management of TB, particularly in high-burden settings.

Material and Method

This descriptive cross-sectional study was conducted at the District Headquarters Hospital in Dera Ismail Khan, Pakistan. The hospital, which cares for tuberculosis patients, is supported by the National Tuberculosis Control Program Pakistan. The sputum microscopy laboratory services and tuberculosis drug regimen adhere to the methods of the National Tuberculosis Control Program.

Between January 1, 2022 and December 31, 2023, 5246 suspicious patients were investigated. A retrospective study was designed. Sputum smear microscopy was carried out utilizing the Ziehl-Nelson

staining method. A positive smear resulted in a positive tuberculosis diagnosis, whereas a negative smear resulted in a negative diagnosis. Demographic information about the patients was gathered, including their age, gender, types of tuberculosis, and previous medical history.

Result

In the current study, 5246 patients with tuberculosis were recorded at DHQ Hospital Dera Ismail Khan, with a male to female ratio of 43.93% and 56.06% as shown in figure 1.

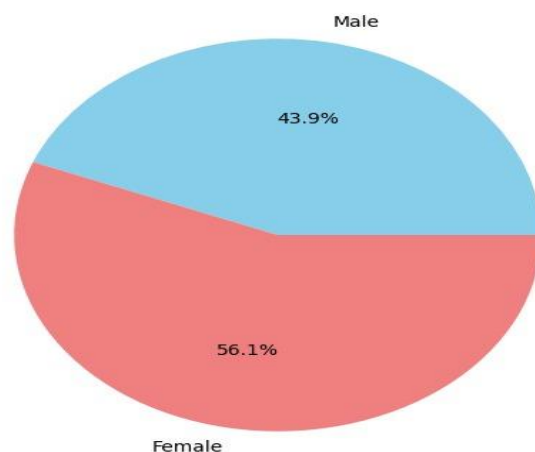


Figure 3: Gender Ratio of TB Cases - A pie chart showing the distribution of male (43.93%) and female (56.06%) patients

A higher number of patients was registered in 2023 than in 2022 as shown in figure 2. On the basis of percentage, a high prevalence of tuberculosis infection was observed in 2022, with an almost identical ratio reported in 2023. The overall prevalence of tuberculosis positive infection was reported to be 38.52 percent.

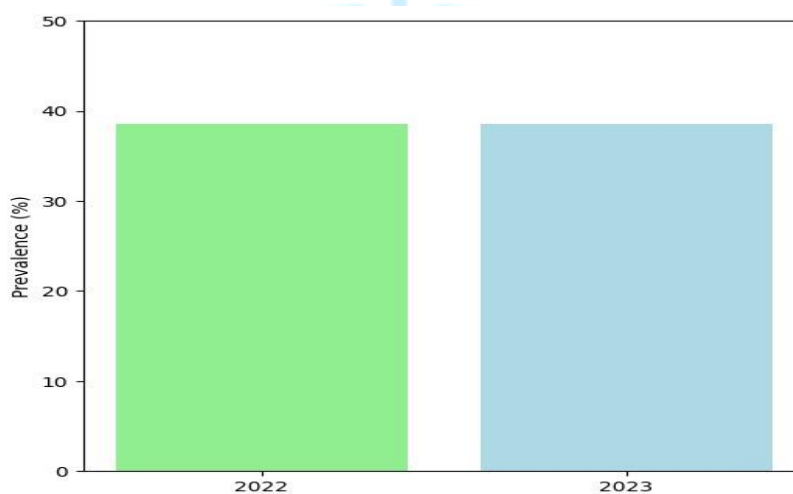


Figure 4: TB Prevalence by Year - A bar chart displaying the identical prevalence percentages (38.52%) for 2022 and 2023.

Pulmonary tuberculosis is 77% more common than extra-pulmonary tuberculosis, which is 23% as shown in figure 3.

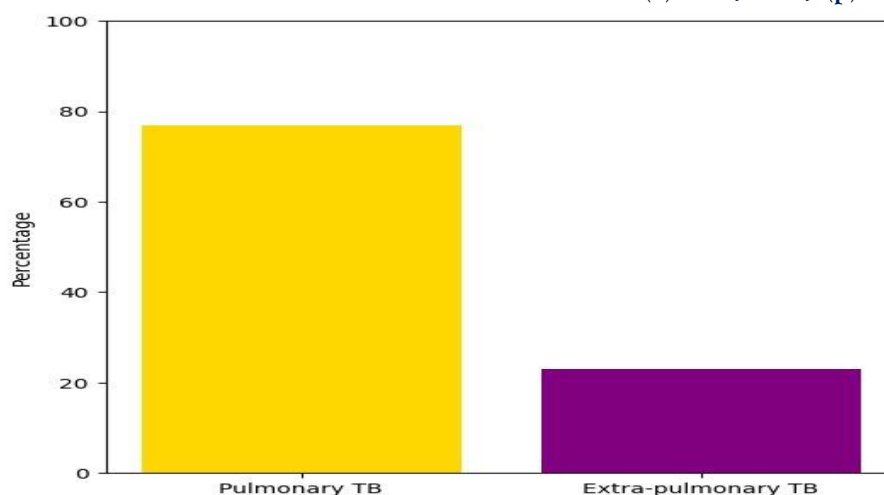


Figure 5: Distribution of TB Types - A bar chart illustrating the higher prevalence of pulmonary tuberculosis (77%) compared to extra-pulmonary tuberculosis (23%).

An age-based examination of pulmonary sputum in smear positive patients revealed that the highest number of cases (18.22%) were recorded in age ≥ 65 years, followed by 15.11% in age 15-24 years, 12.42% in age 55-64 years, 11.18% in age 25-34 years, 8.70% in 45-54 years, 8.28% in age 35-44 years, 3.11% in age 5-14 years, and 0.83% in 0-4 years.

Age-wise analysis of the extra pulmonary sample in smear positive cases revealed that the highest number of cases (04.55%) were documented in age 15-24 years and ≥ 65 years, followed by 3.73% in age 55-64 years, 3.11% in age 25-34 years, 2.48% in 45-54 years, 1.86% in age 5-14 years, 1.24% in age 35-44 years, and 0.62% in 0-4 years as shown in Figure 4.

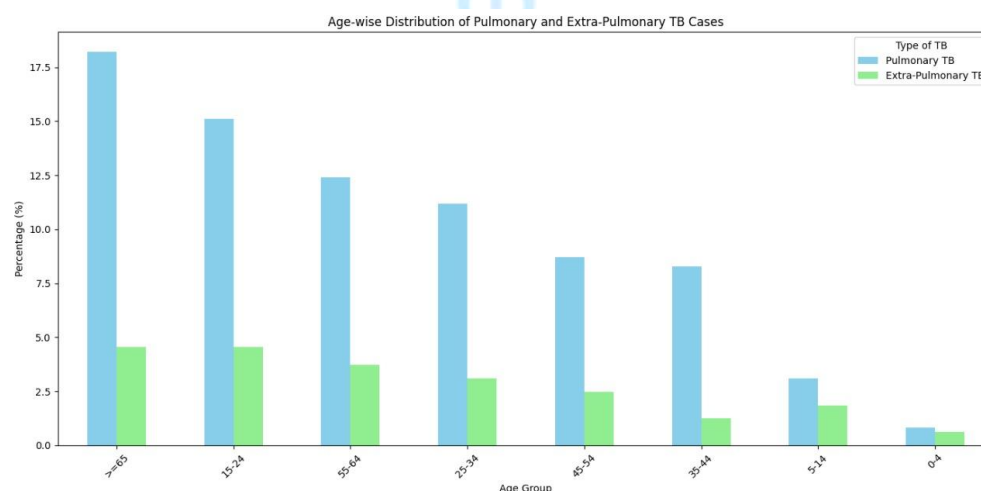


Figure: 6 Age wise Distribution of Pulmonary and extra Pulmonary TB cases among the General population of District Dera Ismail Khan.

Discussion

The current study found a high infection rate of 38.52% in the general population of District Dera Ismail Khan. The total prevalence rate in our study is higher than in earlier studies (10-12). Shams et al.

(10), discovered a 33.08% frequency of tuberculosis infection in District KharBajaur Agency. Investigations done in the designated area of District Dir (Lower) indicated that the overall prevalence rate was 34.71% (11). Ahmad et al. (12) identified a

36.82% prevalence of tuberculosis in District Dir (Lower).

Gender and age have long been recognized as determinants in the incidence and prevalence of tuberculosis. Gender disparities are such indicators that draw attention to both men and women. The condition was more prevalent in female patients than male patients. The disease burden in females was 56.06%, whereas 43.93% of males were smear positive for PTB. Our findings are consistent with recent research that found a high prevalence of tuberculosis in the female population (13).

Why do females advance faster with the disease? Females are more immune-deficient (14). Long and his team conducted a research in Vietnam and discovered that women waited nearly twice as long as men to visit a hospital or health care center after getting a cough. In some cases, women ignored their illness, causing them to become quite ill and the disease to progress quickly (16).

Delays in diagnosing and treating tuberculosis raise the fatality rate and make the disease more easily transmitted to healthy people. In spite of the existence of TB diagnoses, female are disproportionately affected by the stigma associated with the disease. Even in some cultures, TB illness in women may compel them to divorce or, if unmarried, make it impossible to locate a life partner (17).

In our study, the majority of those impacted were middle-aged or older. The occurrence in children and young community was discovered to be low. In a research carry out in northern Pakistan, 61.52% of tuberculosis patients were aged 20 to 50 years (18). The condition primarily affects persons who are older and have more social and economic responsibilities. For their families' social and economic circumstances as well as the nation at large, this could have serious repercussions. In our study, 44.73% of people with pulmonary tuberculosis had positive sputum smears, while 55.26 percent had negative sputum smears. According to a 2011 WHO report, of the 270,394 tuberculosis cases documented in Pakistan, 105,733 were sputum smear positive and 103,824 were sputum smear negative, indicating that almost half of new pulmonary infections were smear positive (19). In a

2010 Polish study, 40.1% of cases of pulmonary tuberculosis tested positive for sputum smear (20).

In our study, 22.89% of patients suffered from EPT. In 2011, 45 537 (16.84%) of the 70 394 total notified cases of tuberculosis were extra pulmonary, with females being impacted more than males (19). EPT has become more common as HIV infection spreads over the world, especially in industrialized nations such as the United States, where it accounts for 10- 15% of tuberculosis cases [21].

Conclusion

The study highlights the considerable burden of tuberculosis in District Dera Ismail Khan, indicating a higher prevalence in females and older age groups, with pulmonary tuberculosis being the most common form of the disease. The findings show a steady rate of tuberculosis cases over a two-year period, with a significant increase in patient registration in 2023 compared to 2022. This analysis emphasizes the critical need for targeted public health programs that focus on early detection and treatment, particularly among vulnerable age groups. Strengthening the National Tuberculosis restrict Program's infrastructure and services, as well as public awareness initiatives, will help to restrict the spread of tuberculosis in the region and improve patient outcomes.

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Author Contributions: Mufakkir Aziz contributed to the conceptualization, study design, data collection, data analysis, original draft writing, and overall project administration. Saleh Aziz assisted in data collection, field supervision, and coordination of ethical approval. Muhammad Shahab Ud Din was responsible for data curation, literature review, and reviewing and editing the manuscript. Muhammad Zubair performed laboratory investigations, provided technical support, Initial format writing, and assisted with sample processing and data analysis. Muhammad Nadeem carried out statistical analysis, contributed to data interpretation, and participated in manuscript review and editing. Muhammad Asif contributed to the preparation of figures and tables,

data visualization, and reference management. Aqsa Khaliq supported the literature review, proofreading, and formatting of the manuscript. Ali Haider provided methodological guidance, supervision, and reviewed the manuscript for final approval. Arbab Haroon contributed to validation, provided necessary resources, and facilitated institutional coordination. All authors read and approved the final version of the manuscript and agreed to be accountable for all aspects of the work.

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