

Mortality Profile of Tuberculosis Patients in Mandya District: A Cross-Sectional Study

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ABSTRACT

Introduction: Tuberculosis (TB) remains a leading cause of mortality globally, especially among immunocompromised individuals such as those living with HIV. In 2022, TB accounted for 1.3 million deaths among HIV-negative individuals and 167,000 among PLHIV. Mortality in TB patients is influenced by factors like age, comorbidities (e.g., malignancy, liver and renal failure), and radiographic patterns. The COVID-19 pandemic significantly disrupted TB services, resulting in reduced case detection and a subsequent rise in TB deaths. Risk factors like sputum positivity, drug resistance, diabetes, and HIV were found to contribute to TB mortality. **Objectives** are to describe the mortality pattern of TB patients registered under NTEP in Mandya district (2018–2023) and to identify risk factors associated with TB mortality. **Methodology:** A facility-based cross-sectional study was conducted involving 168 TB death cases reported between Feb 2018 and Dec 2023. Data were collected via telephonic interviews with close relatives. Complete enumeration was used, and inclusion criteria focused on confirmed TB deaths under NTEP. Data were analyzed using descriptive and bivariate methods. **Results:** Most deaths occurred in males (76%) and individuals aged >60 years (39.2%). Pulmonary TB was present in 84% of cases, and 91.6% were on treatment. Respiratory insufficiency was the leading cause of death (79.6%). Deaths at home were more common (62%). COVID-19 years showed fewer deaths but with shorter diagnosis-to-death durations and longer hospital stays, suggesting pandemic-related service disruptions. **Conclusion:** TB mortality (2018–2023) in Mandya was higher among older, less literate males, with home deaths and COVID-19-related care disruptions highlighting the need for early detection and better healthcare access.

KEYWORDS

Tuberculosis, Mortality, NTEP, Comorbidities

INTRODUCTION

Tuberculosis (TB) remains a significant global health concern, causing substantial mortality despite being preventable and curable. In

2022, TB was responsible for approximately 1.3 million deaths among HIV-negative individuals and an additional 167,000 deaths among people living with HIV (PLHIV),

underscoring its impact on immunocompromised populations.(1) The mortality profile of TB patients is influenced by various factors, including age, comorbidities, and disease presentation. A study analysing culture-proven TB cases reported an overall mortality rate of 12.3%, with a mean age at death of 74 years. Notably, only 17.3% of these deaths were directly attributed to TB, while the majority resulted from non-TB-related causes. Independent predictors of mortality included malignancy, liver cirrhosis, renal failure, and specific radiographic patterns such as miliary and pneumonic infiltrates.(2) HIV compromises the immune system, increasing susceptibility to TB and complicating its progression and treatment.(3) Effective management of TB requires a comprehensive approach that addresses both the infection and associated comorbidities. Early diagnosis, prompt initiation of appropriate therapy, and multidisciplinary care are essential to reduce mortality rates among TB patients. Additionally, addressing risk factors such as HIV infection, diabetes, malnutrition, and smoking is crucial in mitigating the global burden of TB-related deaths.(4) There was a considerable disruption in tuberculosis service provisions in health care settings during the COVID-19 pandemic. Lockdown, social-distancing, isolation strategies and public health guidelines to prevent viral transmission impacted the delivery of all aspects of tuberculosis care. A significantly higher proportion of pulmonary TB cases were reported during post-lock down period compared to that of pre-lock down.(5) Sputum positivity, drug resistance, gender, and presence of comorbidities such as DM and HIV contributed to mortality. A drop in presumptive TB cases and notification of TB cases compared to previous years were noted during the pandemic phase.(6) Significant drop was observed in suspected TB cases in 2020 compared to 2019.(7) Total deaths increased in 2021 compared to 2020, decreases did occur in 2021 compared to 2019.(8) During COVID-19 pandemic there was dip in case diagnosis. Post COVID-19 there was surge in TB deaths.(9)

Objectives

- To describe the mortality pattern of TB patients registered under NTEP in Mandya district between 2018-2023.
- To describe the associated risk factors of TB mortality in study population.

MATERIAL & METHODS

Study Design: Facility based Cross-sectional study

Study Population: The TB deaths, which occurred during the period of 2018-2023 and outcome assigned as TB death by NTEP. Information obtained from the closest reliable family member.

Sample Size: 168 TB death cases between 18/02/2018 - 28/12/2023 according to line list of deaths obtained from the NIKSHAY portal. Closest relatives of the deceased were accessible over phone and responded to interviewers.

Sampling Technique: Complete enumeration.

Inclusion Criteria:

Pulmonary and extra pulmonary tuberculosis cases declared as dead by NTEP during the period of 2018-2023

Informed consent was obtained by closest reliable family member

Exclusion Criteria:

Participants whose phone were not reachable or was not received after 2 attempts

Data collection:

- Permission was taken from the district TB officer.
- Line list of TB deaths was obtained from the District TB Office & DOTS center, Mandya from NIKSHAY portal.
- Semi-structured questionnaire was prepared to obtain the socio-demographic details, TB disease related information, details of hospitalization complications and co-morbidities and death related information.
- Information was collected by telephonic interview of the family members of the deceased.
- Statistical analysis: Data was entered in Excel and analysed to generate comparative proportions-mean, standard deviation of the study variables.

- Year wise comparison for risk features of mortality was analysed in bivariate analysis.

RESULTS

It was observed that among the study participants, majority i.e., 39.2% of them belonging to > 60 years of age, followed by 33.6% were in the age group of 46-60 years. 76% of total participants were males. 43.2% were non-literate and only 2.4% were graduates. 72.8% were farmers and 4.8% were students or unemployed.

Of the individuals, 68.4% experienced a mix of symptoms, such as coughing and weight loss; 16.4% smoked and drank alcohol, and 25.2% consumed both. Respiratory insufficiency was identified as the cause of death in 79.6% of

cases. Figure 2 shows that 90% of the TB cases in this study were newly diagnosed and 10% had previously received treatment. 84% of participants had pulmonary TB and 91.6% of the patients were receiving ATT treatment. About 38% of study participants were hospitalized at the time of their death, and 62% of study participants passed away at home. 15.6% were drug resistant and 93.2% were compliant to treatment

During the year 2020-2021, figure 1 shows that number of deaths were less and table 1 shows that the median duration of symptom onset, duration of diagnosis, treatment initiation to death had decreased among the study participants also duration of admission increased in the same time period. This variation might be due the COVID pandemic which occurred during the year 2021-2022.

Figure1: Distribution of year wise mortality among the study participants

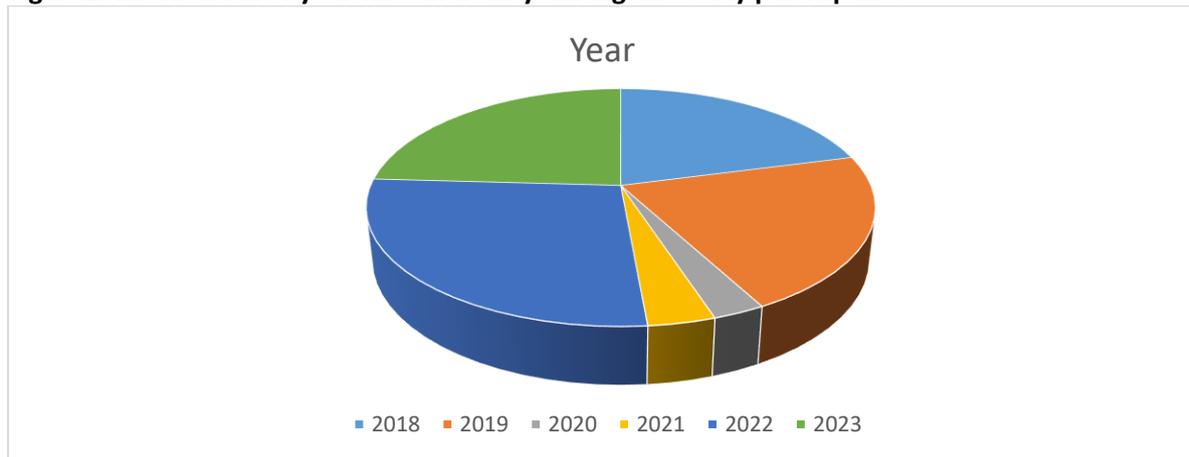


Figure2.1: Distribution of treatment and outcome indicators in pulmonary TB patients

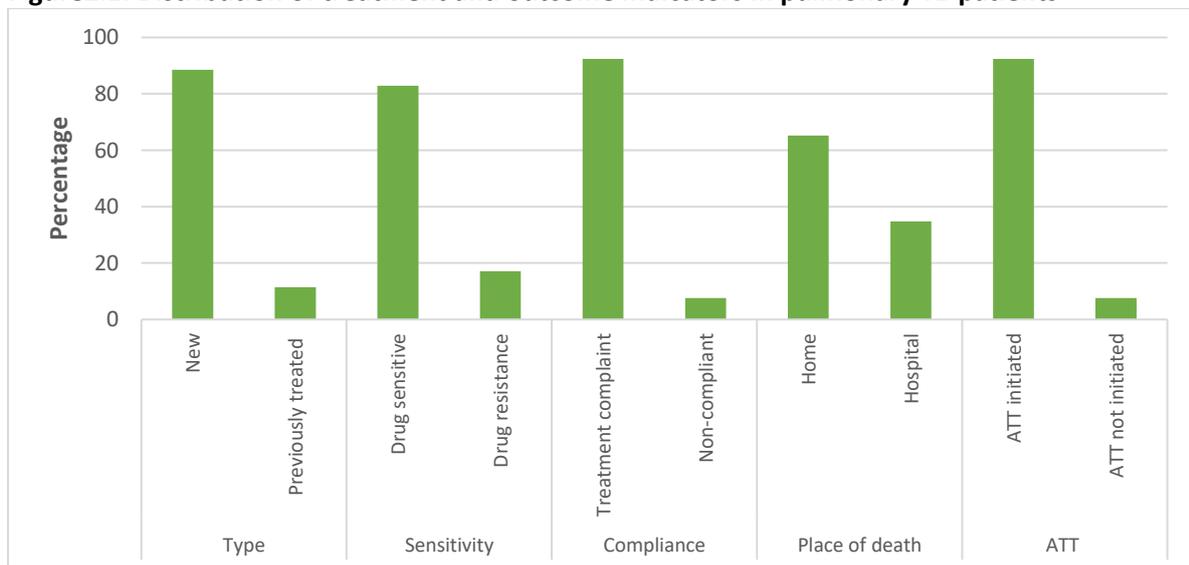


Figure 2.2: Distribution of treatment and outcome indicators in extrapulmonary TB patients

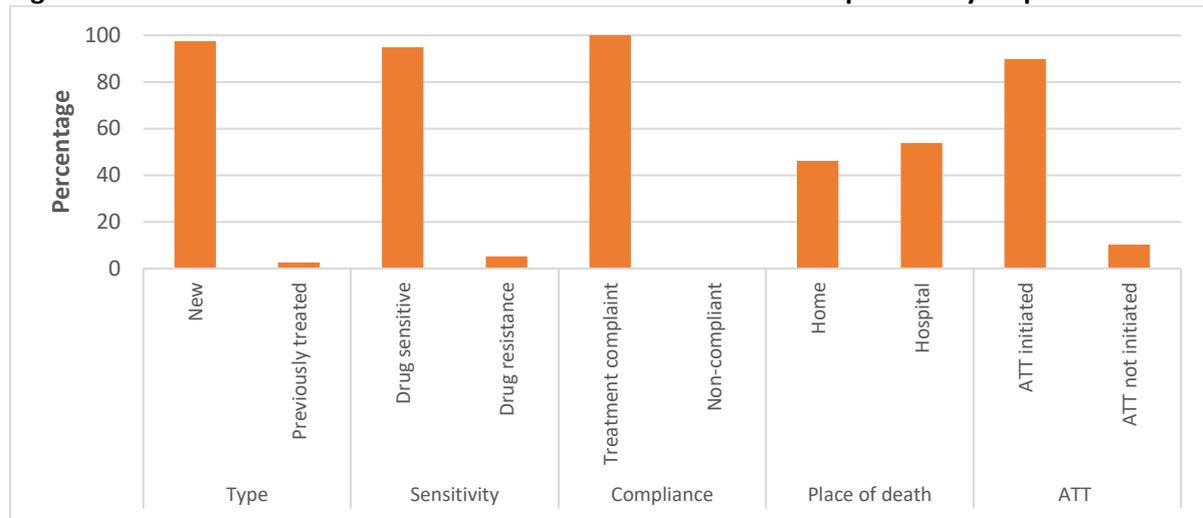


Table 1: Variation of median duration of symptom onset, diagnosis, treatment initiation to death and days of hospital admission in TB patients

		Pre-Covid	During Covid	Post- Covid
Duration of symptom onset to death	Median	62	54	72
	Range	336	123	339
Duration of diagnosis to death	Median	30	24	30
	Range	267	109	294
Duration of treatment initiation to death	Median	30	24	30
	Range	218	109	286
Duration of admission	Median	8	10	9
	Range	45	20	57

DISCUSSION

In one study the TB mortality rate in South India was found to be 0.20 per 1000 person-days, with a 1-year mortality rate of 4.6% among newly diagnosed drug-sensitive pulmonary TB patients.(10) In another one study among HIV-infected TB patients, the mortality rate during treatment is significantly higher compared to HIV-uninfected patients.(11) In the present study, the mortality rate was more in the year 2022 i.e. 27.2%.

Age and Gender: Older age and male gender are significant predictors of mortality among TB patients. Studies have shown that older patients and males have higher mortality rates compared to younger patients and females.(10,12)

Comorbidities: The presence of comorbid conditions such as diabetes, HIV co-infection, and other chronic illnesses significantly increases the risk of mortality in TB patients.

HIV co-infection, in particular, has been associated with higher mortality rates.(11,12) Nutritional Status: Undernutrition is a critical risk factor for increased mortality in TB patients. Malnourished patients are more likely to succumb to the disease.(12) In our study, among the TB patients 20.4% had diabetes, followed by 14.8% had HIV.

A study by Taneja et al. in 2022 found that delays in seeking care and initiating TB treatment were widespread even before the pandemic, with a median of 40 days from symptom onset to diagnosis and a further delay of 15 days before treatment initiation. However, the pandemic amplified these delays.(13) Another study in India during COVID-19 reported a 25% reduction in TB case notifications and worsening treatment outcomes.(14) In our present study, the median duration from symptom onset to death shows variability, ranging from the lowest value in 2021 (33 days) to the highest in 2023 (80.5 days). Shorter durations in 2021 can be

linked to the COVID-19 pandemic, which disrupted healthcare services.

A study by Meneguim et al. in 2021 reported that the COVID-19 pandemic contributed to an increase in the severity of TB at presentation, leading to longer hospital stays in many countries, including India.(15) Pai et al in 2022 highlighted that post-pandemic improvements in TB management, such as shorter drug regimens and enhanced diagnostics, have helped reduce hospitalization durations for mild-to-moderate TB cases.(16) Evidence from ICMR's National TB Elimination Program indicates that decentralized care models and ambulatory management are reducing the dependency on prolonged hospital stays.(17) In our study the median hospital admission durations for TB patients from 2018 to 2023 reflect evolving healthcare practices and external challenges like the COVID-19 pandemic. The longer stays in 2021 highlight the pandemic's impact on delayed diagnosis and advanced disease severity, while shorter stays in subsequent years indicate recovery and improvements in TB care delivery. Enhanced diagnostics, decentralized care models, and strengthened healthcare infrastructure have contributed to reducing hospital dependency and ensuring better patient outcomes. Continued focus on early detection and community-based management is vital to sustain these gains.

CONCLUSION

The study highlights that TB mortality in Mandya district between 2018 and 2023 was predominantly seen among older males, individuals with low literacy levels, and those engaged in farming. A significant proportion of the deceased experienced multiple symptoms and had pulmonary TB, with most being newly diagnosed and compliant with treatment. Respiratory insufficiency emerged as the leading cause of death. The majority of deaths occurred at home, indicating potential gaps in access to timely or adequate care. Notably, the COVID-19 pandemic period showed a decline in reported TB deaths, possibly due to underdiagnosis or reduced health-seeking behavior, but was associated with shorter intervals from diagnosis to death and longer

hospital stays. These findings underscore the need for enhanced early detection, improved community awareness, and strengthened healthcare access, especially during public health emergencies.

LIMITATION OF THE STUDY

Recall bias: Information was obtained retrospectively from family members via telephone interviews, potentially introducing recall bias regarding symptom timeline and clinical events surrounding death **Selection bias:** Participants whose phone numbers were unreachable or who declined participation were excluded

RELEVANCE OF THE STUDY

This study contributes critical district-level mortality data that fills an important evidence gap in the Indian TB control program. It also provides valuable documentation of how the COVID-19 pandemic specifically affected TB mortality patterns and healthcare-seeking behaviour in a rural Indian district.

AUTHORS CONTRIBUTION

SS: Conception and design of the study, data collection, data analysis and interpretation, manuscript writing, critical revision, and approval of final version. **ABA:** Study design, data collection protocol development, data interpretation, manuscript review and critical revision, and approval of final version.

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Nil

CONFLICT OF INTEREST

There are no conflicts of interest.

DECLARATION OF GENERATIVE AI AND AI ASSISTED TECHNOLOGIES IN THE WRITING PROCESS

NIL

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