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Original Article

# Year wise comparison of Rifampicin Resistance in Tuberculosis: An Emerging Concern

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## ABSTRACT

**Background**: Rifampicin resistance is a critical marker for multidrug-resistant tuberculosis (MDR-TB). Recently, rifampicin intermediate resistance has emerged as an important early warning indicator for impending drug resistance. Monitoring year-wise trends is essential for programmatic and clinical decision-making.
**Objective**: To compare the burden of rifampicin-resistant and rifampicin-intermediate tuberculosis cases between the years 2024 and 2025.
**Methods**: A retrospective comparative analysis of NTEP laboratory data for the years 2024 and 2025 was performed. Total TB cases, rifampicin-resistant cases, and rifampicin-intermediate cases were analyzed and compared using proportions.
**Results**: Total TB cases increased from 313 in 2024 to 350 in 2025. Rifampicin-resistant cases increased from 2 (0.64%) in 2024 to 9 (2.57%) in 2025, showing a four-fold rise. Rifampicin-intermediate cases increased from 121 (38.66%) in 2024 to 181 (51.71%) in 2025, indicating a substantial rise in intermediate resistance.
**Conclusion**: A significant increase in both rifampicin resistance and intermediate resistance was observed in 2025. The rising proportion of intermediate resistance may represent a precursor stage to future MDR-TB and warrants urgent attention under NTEP.

***Keywords***: *Tuberculosis, Rifampicin resistance, Intermediate resistance, MDR-TB, NTEP, India.*

## INTRODUCTION

Tuberculosis (TB) continues to be a major global health challenge despite sustained control efforts, with India accounting for the largest share of the global TB burden [1,19]. According to the World Health Organization (WHO), the emergence and spread of drug-resistant tuberculosis, particularly rifampicin-resistant TB (RR-TB) and multidrug-resistant TB (MDR-TB), pose a serious threat to achieving the targets of TB elimination [1,2].

Rifampicin is a cornerstone drug in first-line anti-tubercular therapy due to its potent sterilizing activity. Resistance to rifampicin is therefore considered a reliable surrogate marker for MDR-TB, as it is frequently associated with concurrent isoniazid resistance [3,4]. Early identification of rifampicin resistance is critical for initiating appropriate second-line regimens and preventing ongoing transmission.

Our previous study [23] concluded in 2014 that molecular diagnostic modalities will be the future of diagnosis of Tuberculosis and the introduction of rapid molecular diagnostic platforms such as Cartridge-Based Nucleic Acid Amplification Test (CBNAAT) and TruNat under national TB programs has revolutionized TB diagnosis and drug-resistance detection [6,18]. These technologies have not only improved case detection but have also enabled identification of **rifampicin intermediate resistance**, a category that reflects reduced drug susceptibility due to specific rpoB gene mutations [15].

Rifampicin intermediate resistance has gained increasing attention in recent years. Several studies have demonstrated that isolates with intermediate resistance may be associated with delayed sputum conversion, suboptimal treatment response, and progression to full resistance if inadequately managed [7,15]. However, programmatic data on the burden and temporal trends of rifampicin intermediate resistance remain limited, particularly in high TB burden countries like India.

India's National Tuberculosis Elimination Programme (NTEP) emphasizes universal drug susceptibility testing at diagnosis to ensure early detection of drug resistance [19]. Continuous surveillance of rifampicin resistance patterns, including intermediate resistance, is essential to guide treatment policies and optimize antimicrobial stewardship.

While multiple studies have reported the prevalence of rifampicin resistance, comparative **year-wise analyses** highlighting changes in both rifampicin-resistant and rifampicin-intermediate cases are scarce. Moreover, most published data focus primarily on resistance, often overlooking the epidemiological significance of intermediate resistance.

The present study was undertaken to compare rifampicin-resistant and rifampicin-intermediate tuberculosis cases between the years 2024 and 2025 using routine NTEP laboratory data. By analyzing year-wise trends, this study aims to provide early insights into evolving resistance patterns and their potential implications for TB control strategies.

## MATERIALS AND METHODS

### Study Design

A retrospective observational comparative study.

### Study Period

January 2024 to December 2025.

### Data Source

Laboratory records generated under NTEP from molecular TB diagnostic testing.

### Study Variables

- Total TB cases detected
- Rifampicin-resistant cases
- Rifampicin-intermediate cases

### Definitions

- **Rifampicin resistant:** Detection of mutations conferring high-level resistance to rifampicin.
- **Rifampicin intermediate:** Detection of mutations associated with reduced rifampicin susceptibility.
- **Percent resistance:** Proportion of resistant or intermediate cases among total TB cases.

### Statistical Analysis

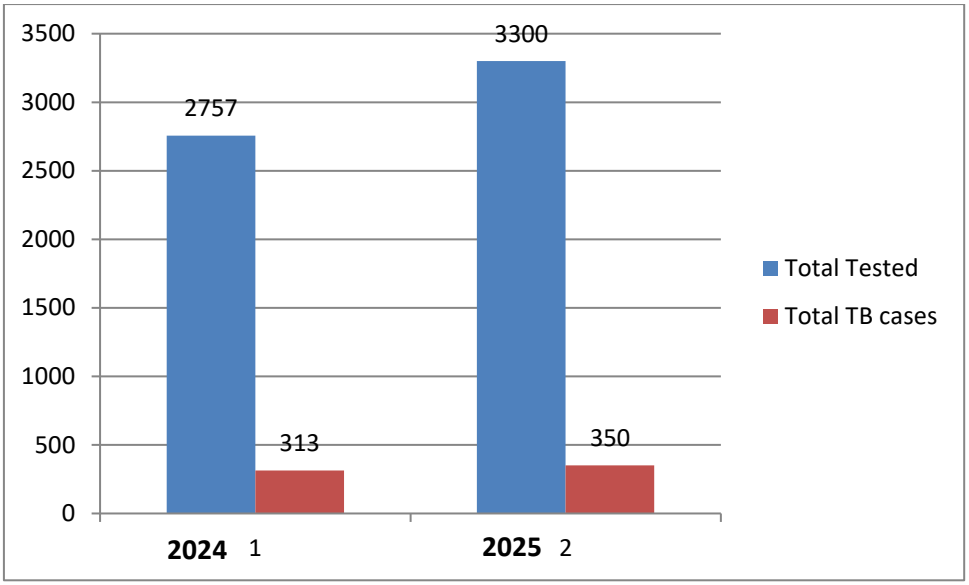
Data were summarized using absolute numbers and percentages. Year-wise comparisons were made descriptively to identify trends.

### Ethical Consideration

The study utilized anonymized, programmatic laboratory data without patient identifiers; hence, formal ethical approval was not required.

## RESULTS

As per **figure 1** Total TB cases were **313 in 2024** to **350 in 2025**,out of total tested cases 2757 and 3300, respectively. Indicating a rise in diagnostic yield andTuberculosis burden.




**Rifampicin Resistance**

As per **table 1**and **figure 2**Rifampicin-resistant cases increased from **2 cases (0.64%) in 2024** to **9 cases (2.57%) in 2025**, reflecting a more than four-fold increase in proportion.

**Rifampicin Intermediate Resistance**

As per **table 1** and **figure 2**Rifampicin-intermediate cases increased from **121 cases (38.66%) in 2024** to **181 cases (51.71%) in 2025**, showing a marked escalation in intermediate resistance.

**TABLES**

**Table 1. Year-wise Comparison of Rifampicin Resistance and Intermediate Resistance**

| Parameter | 2024 | 2025 |
|---|---|---|
| Total TB cases | 313 | 350 |
| Rifampicin resistant cases | 2 | 9 |
| % Rifampicin resistance | 0.64% | 2.57% |
| Rifampicin intermediate cases | 121 | 181 |
| % Rifampicin intermediate | 38.66% | 51.71% |

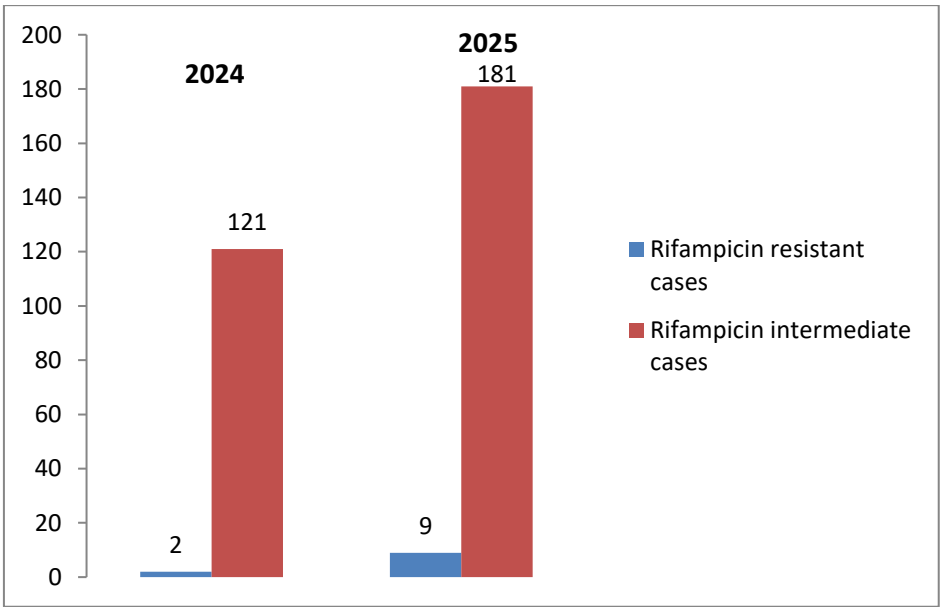



**Figure 2: Rifampicin resistance and intermediate resistance cases**

## DISCUSSION

The present study demonstrates a clear and concerning increase in rifampicin resistance as well as rifampicin intermediate resistance in 2025 compared to 2024. The proportion of rifampicin-resistant cases increased more than four-fold within a single year, while rifampicin-intermediate cases showed a substantial rise, crossing 50% of total diagnosed cases.

The observed increase in rifampicin resistance is consistent with global and national trends reported in recent WHO and Indian TB surveillance reports [1,19]. Similar rising patterns have been documented in other high-burden settings, where improved molecular diagnostics have uncovered a previously under-recognized pool of drug-resistant TB cases [3,9].
More noteworthy, however, is the marked rise in rifampicin intermediate resistance. Intermediate resistance has increasingly been recognized as a biologically and clinically significant category rather than a mere laboratory artifact [7,15]. Mutations associated with intermediate resistance may confer partial drug activity, allowing bacterial survival under inadequate drug exposure and thereby facilitating the development of high-level resistance [15,21].

Several studies have reported poorer treatment outcomes among patients harboring rifampicin-intermediate strains when treated with standard first-line regimens [7,14]. This underscores the importance of identifying and closely monitoring such cases under programmatic conditions. The rising proportion of intermediate resistance observed in this study may represent an early warning signal for a future increase in MDR-TB burden if corrective measures are not implemented.

Multiple factors may contribute to the observed trends, including prior incomplete or irregular treatment, inappropriate antibiotic use, delayed diagnosis, and improved sensitivity of molecular assays [4,8,16]. Additionally, increased testing coverage under NTEP may have led to better detection of resistance patterns that were previously missed [18,19].

The findings of the present study reinforce the importance of laboratory-driven TB management. Earlier work by Shrivastava et al. emphasized the role of combining diagnostic modalities for accurate TB diagnosis [23,24]. Extending this principle to drug resistance, comprehensive susceptibility testing at baseline is essential for guiding individualized therapy and preventing amplification of resistance.

From a public health perspective, the rising burden of rifampicin intermediate resistance highlights the need for strengthening antimicrobial stewardship, ensuring strict treatment adherence, and considering regimen optimization for patients with reduced drug susceptibility [10,22]. Programmatic guidelines may need to evolve to address the clinical management of intermediate resistance more explicitly.

This study has certain limitations. Being based on programmatic laboratory data, clinical outcomes and mutation-specific analyses were not available. Additionally, the data represent a single-center experience, which may limit generalizability. Nevertheless, the study provides valuable real-world evidence and highlights emerging resistance trends that merit urgent attention.

## CONCLUSION

A significant increase in rifampicin resistance and rifampicin-intermediate resistance was observed in 2025 compared to 2024. The rising burden of intermediate resistance serves as an early warning for future MDR-TB cases. Strengthening antimicrobial stewardship, ensuring treatment adherence, and close monitoring of intermediate resistance are crucial for achieving TB elimination goals.

## REFERENCES


1. World Health Organization. **Global tuberculosis report 2024**. Geneva: World Health Organization; 2024.
2. World Health Organization. **Consolidated guidelines on tuberculosis: Module 4 – treatment of drug-resistant tuberculosis**. Geneva: World Health Organization; 2023.
3. Lange C, Dheda K, Chesov D, Mandalakas AM, Udwadia Z, Horsburgh CR Jr. **Management of drug-resistant tuberculosis**. *Lancet*. 2023; 402(10414):1829–1844.
4. Dheda K, Gumbo T, Maartens G, Dooley KE, Murray M, Furin J, et al. **The epidemiology, pathogenesis, transmission, diagnosis, and management of multidrug-resistant, extensively drug-resistant, and incurable tuberculosis**. *N Engl J Med*. 2024; 390(2):115–127.
5. Pai M, Behr MA, Dowdy D, Dheda K, Divangahi M, Boehme CC, et al. **Tuberculosis**. *Nat Rev Dis Primers*. 2023; 9(1):19.
6. Boehme CC, Nabeta P, Hillemann D, Nicol MP, Shenai S, Krapp F, et al. **Rapid molecular detection of tuberculosis and rifampin resistance**. *N Engl J Med*. 2010; 363(11):1005–1015.
7. Van Rie A, Warren R, Richardson M, Victor TC, Gie RP, Enarson DA, et al. **Classification of drug-resistant tuberculosis in an era of molecular diagnostics**. *Clin Infect Dis*. 2022; 74(6):1089–1096.

8. Migliori GB, Tiberi S, Zumla A, Petersen E, Chakaya J, Wejse C, et al. **Multidrug-resistant tuberculosis and extensively drug-resistant tuberculosis: challenges and solutions**. *EurRespir J*. 2023; 61(2):2201998.
9. Gupta A, Anupurba S, Bansal R, Chandra H. **Trends in rifampicin-resistant tuberculosis in India: implications for national TB elimination programme**. *Indian J Med Res*. 2022; 155(2):232–240.
10. Sharma SK, Mohan A. **Tuberculosis in India: burden, challenges and strategies for control**. *Indian J Med Res*. 2023; 158(1):7–17.
11. Lawn SD, Zumla AI. **Tuberculosis**. *Lancet*. 2011; 378(9785):57–72.
12. Chakaya J, Khan M, Ntoumi F, Aklillu E, Fatima R, Mwaba P, et al. **Global tuberculosis report 2023 – reflections on the global TB burden, treatment and prevention efforts**. *Int J Infect Dis*. 2023; 124(Suppl 1):S1–S10.
13. Ahmad S, Mokaddas E. **Recent advances in the diagnosis and treatment of multidrug-resistant tuberculosis**. *J ClinMicrobiol*. 2021; 59(2):e02413–20.
14. Mase SR, Chorba T. **Treatment of drug-resistant tuberculosis**. *Clin Chest Med*. 2019; 40(4):775–795.
15. Miotto P, Cabibbe AM, Borroni E, Degano M, Cirillo DM. **Role of disputed rpoB mutations in rifampicin-resistant tuberculosis**. *EurRespir J*. 2018; 51(1):1801352.
16. Singh N, Sharma BB, Soneja M, Mehta PK, Jain NK. **Drug-resistant tuberculosis in India: current status and challenges**. *BMC Infect Dis*. 2022; 22:641.
17. Kumar P, Mehra M, Malhotra B. **Pattern of rifampicin resistance detected by CBNAAT in a tertiary care hospital**. *PLoS One*. 2021; 16(5):e0250908.
18. World Health Organization. **WHO operational handbook on tuberculosis: Module 3 – diagnosis**. Geneva: World Health Organization; 2023.
19. Central TB Division. **India TB report 2024**. New Delhi: Ministry of Health and Family Welfare, Government of India; 2024.
20. Jain A, Dixit P, Prasad R. **Prevalence of multidrug-resistant tuberculosis in India: a systematic review**. *Indian J Tuberc*. 2023; 70(2):111–118.
21. Lange C, Chesov D, Heyckendorf J, Leung CC, Udwadia ZF, Dheda K. **Drug-resistant tuberculosis: an update on disease burden, diagnosis and treatment**. *EurRespir Rev*. 2022; 31(164):210195.
22. Dheda K, Barry CE III, Maartens G. **Tuberculosis**. *Lancet Respir Med*. 2024; 12(1):10–24.
23. **Shrivastava G, Bajpai T, Bhatambare GS, Patel PKB.** Genital tuberculosis: comparative study of the diagnostic modalities. *J Hum Reprod Sci*. 2014; 7(1):30–33.
24. **Shrivastava G, Patel DKBP.** Genital tuberculosis: evaluating microscopy, culture, histopathology and PCR for diagnosis. *Int J CurrMicrobiol App Sci*. 2014; 3(4):439–445.
25. Zignol M, Dean AS, Falzon D, van Gemert W, Wright A, van Deun A, et al. **Twenty years of global surveillance of antituberculosis-drug resistance**. *N Engl J Med*. 2016; 375(11):1081–1089.
26. Cohen KA, Manson AL, Abeel T, Desjardins CA, Chapman SB, Hoffner S, et al. **Extensive global movement of multidrug-resistant M. tuberculosis strains revealed by whole-genome analysis**. *Thorax*. 2019; 74(9):882–889.
27. Udwadia ZF, Moharil G. **Multidrug-resistant tuberculosis treatment in India: challenges and opportunities**. *Indian J Tuberc*. 2018; 65(3):215–220.
28. Chakraborty S, Rhee KY. **Tuberculosis drug development: history and evolution of the mechanism-based paradigm**. *Cold Spring HarbPerspect Med*. 2015; 5(8):a021147.
29. Kendall EA, Cohen T. **Mitigating the burden of tuberculosis drug resistance**. *Clin Infect Dis*. 2020; 71(7):1674–1681.
30. Daley CL, Caminero JA. **Management of multidrug-resistant tuberculosis**. *SeminRespirCrit Care Med*. 2018; 39(3):310–324.