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Original Research Article

AGE AND GENDER DISTRIBUTION OF TUBERCULOSIS PATIENTS IN SOUTH INDIA: A RETROSPECTIVE OBSERVATIONAL STUDY

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ABSTRACT

Background: Tuberculosis remains a major public health concern in India, and rifampicin resistance complicates disease control. Although age and sex differences in tuberculosis are known, regional data on rifampicin-resistant tuberculosis remain limited. This study aimed to describe the age and sex distribution of rifampicin-resistant tuberculosis among patients diagnosed in a South Indian population using retrospective observational data. **Materials and Methods:** This retrospective cross-sectional descriptive study was conducted at a government tertiary care hospital in Salem, South India. We reviewed the records of patients with tuberculosis registered under the National Tuberculosis Elimination Programme from January 2020 to December 2023 and identified rifampicin resistance using Xpert MTB/RIF testing. **Results:** Of 15,200 patients with tuberculosis evaluated, 410 (2.69%) had rifampicin-resistant disease. Males constituted 295 cases (72%) and females 115 (28%). Among males, the 41–50-year age group accounted for the largest share (47.1%), followed by 21–30 years (38.6%), while 31–40 years (12.9%) and 51–60 years (1.4%) contributed few cases. In females, two-thirds of cases occurred in the 41–50-year group (67%), with smaller proportions in 31–40 years (18.3%) and 21–30 years (12.2%), and only isolated cases in 51–60 years. No rifampicin-resistant cases were observed in children or in individuals aged >60 years. **Conclusion:** Rifampicin-resistant tuberculosis in this South Indian study group showed clear age and sex variation, with a higher burden among males and clustering in working-age adults. These findings highlight the need for focused screening and early resistance detection in high-risk age groups.

INTRODUCTION

Tuberculosis is one of the most common infectious diseases reported in India.[1] Drug resistance complicates treatment and increases programme difficulty.[2] Rifampicin resistance is used as a key marker for multidrug-resistant tuberculosis and is routinely detected using molecular assays such as Xpert MTB/RIF under the National Tuberculosis Elimination Programme.[3] National surveillance data show higher tuberculosis notification rates in men than women.[4] The reported global male-to-female ratio is approximately 1.6:1.[5] This difference appears after adolescence and continues through middle age.[6] Most surveillance reports describe the overall tuberculosis burden and do not provide a detailed age-wise distribution of rifampicin-resistant cases.[7]

Sex differences in tuberculosis are visible across many endemic regions.[8] Adult men account for a large proportion of pulmonary tuberculosis notifications, particularly between 30 and 50 years of age.[9] Occupational exposure, smoking, alcohol use, and delayed health-seeking behaviour contribute to higher case detection in men than in women. In contrast, women in some settings show higher notification rates in younger age groups, especially between 20 and 30 years of age. Household contact and access to maternal health services influence detection patterns. This suggests that age modifies the distribution of tuberculosis by sex.[10] Whether the same pattern exists specifically for rifampicin-resistant tuberculosis requires structured age- and sex-based analysis.

Rifampicin resistance develops either through the transmission of resistant strains or the acquisition during incomplete or irregular treatment. The expanded use of rapid molecular testing has increased the identification of resistant cases across all adult age groups.[1] Routine hospital records contain age, sex, and rifampicin status, which allow for stratified analysis without additional data collection. Age grouping helps identify the concentration of resistance in specific decades of life. Sex comparison within each age band clarifies whether the resistance rate shows the overall tuberculosis distribution or shows a different pattern. Such descriptive analyses are important in hospital-based program settings, where resistance data are often reported in aggregate form.

Published data from South India describing the detailed age and sex distribution of rifampicin-resistant tuberculosis are limited. Most available reports present overall resistance proportions or treatment outcomes without demographic stratification of the data. The lack of a structured age–sex analysis restricts the understanding of which population segments contribute most to resistance notifications. A retrospective observational study using existing program records can address this gap by presenting resistance distribution across defined age categories separately for men and women. Therefore, this study aimed to describe the age and sex distribution of rifampicin-resistant tuberculosis among patients diagnosed in a South Indian population.

MATERIALS AND METHODS

This retrospective cross-sectional descriptive study was conducted at a government tertiary care hospital in Salem, South India, with data collected from January 2020 to December 2023. The Institutional Ethics Committee approved the study protocol before data collection.

Inclusion and exclusion criteria

The study included patients with tuberculosis registered under the National Tuberculosis Elimination Programme who underwent Xpert MTB/RIF testing, were treated at the study hospital between January 2020 and December 2023, and had complete age, sex, and rifampicin resistance records. Patients were excluded if rifampicin resistance test results were unavailable, demographic data were incomplete, diagnosis occurred outside the study period, cases were referred only for follow-up or continuation therapy, or extrapulmonary tuberculosis lacked microbiological confirmation of rifampicin status.

Methods

Data were obtained from routinely maintained tuberculosis programme records at a government tertiary care hospital in Salem, South India. A total of 15,200 patients diagnosed with tuberculosis and registered under the National Tuberculosis Elimination Programme were reviewed. Among them, 410 microbiologically confirmed rifampicin-resistant tuberculosis cases were included for the analysis of age and sex distribution. The dataset included patient age, sex, rifampicin resistance status, and the year of registration. Rifampicin resistance was determined using the Xpert MTB/RIF assay performed at the time of diagnosis as part of the standard diagnostic practice under the National Tuberculosis Elimination Programme.

The age at diagnosis was recorded in completed years and grouped into predefined age categories. Sex was recorded as male or female, as documented in the program records. Rifampicin-resistant cases were identified and stratified according to age group and sex. Data were analysed using SPSS V29. Data were presented in frequencies and percentages.

RESULTS

Among the 410 rifampicin-resistant patients, 295 were males (72%), and 115 were females (28%). [Table 1]

Table 1: Distribution of rifampicin status between genders (n = 410)

Gender	Rifampicin-Resistant n (%)
Male	295 (72%)
Female	115 (28%)

Among male patients with rifampicin-resistant tuberculosis, the highest number of cases was observed in the 41–50-year age group (139 cases, 47.1%), followed by the 21–30-year group (114 cases, 38.6%). Fewer male cases were recorded in the 31–40-year age group (38 cases, 12.9%) and very few in the 51–60-year age group (4 cases, 1.4%). No rifampicin-resistant cases were observed among males in the 0–10, 11–20, and 61–70-year age groups.

Among female patients, rifampicin-resistant tuberculosis was most frequent in the 41–50-year age group, with 77 cases (67%), followed by the 31–40-year group with 21 cases (18.3%) and the 21–30-year group with 14 cases (12.2%). Only one case was observed in the 51–60-year age group (0.8%), and two cases were recorded in the 11–20-year age group (1.7%). No rifampicin-resistant cases were identified among women in the 0–10 and 61–70-year age groups. [Table 2]

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Table 2: Age and gender distribution of rifampicin-resistant tuberculosis cases (n = 410)

Age Group (years)	Male RR n (%)	Female RR n (%)
0–10	0	0
11–20	0	2 (1.7%)
21–30	114 (38.6%)	14 (12.2%)
31–40	38 (12.9%)	21 (18.3%)
41–50	139 (47.1%)	77 (67%)
51–60	4 (1.4%)	1 (0.8%)
61–70	0	0

DISCUSSION

This study found that rifampicin-resistant tuberculosis was more common among males than females, with cases predominantly clustered in young and middle-aged adults. The highest burden occurred in the 41–50-year age group, followed by the 21–30-year age group. Rifampicin resistance is rare in children, adolescents, and older adults.

In our study, among male patients with rifampicin-resistant tuberculosis, the highest proportion was in the 41–50-year age group. Similarly, Priya et al. found in a study of 670 tuberculosis patients that rifampicin resistance was identified in 59 cases (8.8%), with males accounting for 41 cases (69.5%). The 41–50-year age group represented the largest proportion of patients, with 165 cases (24.6%).[11] Adi et al. reported in a study of 338 drug-resistant tuberculosis patients that the highest case concentration occurred in the 41–50-year age group with 92 patients (27.1%), followed by the 31–40-year group (20.4%) and the 51–60-year group (20.1%).[12] These studies confirm male predominance and concentration of rifampicin-resistant tuberculosis in middle-aged adults, supporting our observed peak in the 41–50-year age group across comparable clinical and programmatic settings.

This study showed that the second-highest proportion of rifampicin-resistant cases among men was observed in the 21–30-year age group. Similarly, Reddy et al. found that in the IJPCR study of 780 patients, rifampicin resistance was detected in 35 cases (4.3%), with 11 cases (31.4%) occurring in the 21–30-year age group, representing a major contributor to resistant cases.[13] Seifert et al. found that in the Myanmar Xpert MTB/RIF analysis of individuals, rifampicin resistance among males was highest in the 21–25-year age group, affecting 13.1% of Mtb-positive cases.[14] These findings show that rifampicin resistance is common among young adult men, especially those aged 21–30 years, which directly supports our observation that this age group contributes substantially to male rifampicin-resistant tuberculosis cases.

Our study shows that male rifampicin-resistant cases were fewer in the 31–40 and 51–60 years age groups, with none in the extreme age groups. Similarly, Kumari et al. found that in a study of 455 patients with tuberculosis, 98 (21.5%) were rifampicin-resistant; the age-wise distribution showed 20 cases in the 31–40-year group and 15 cases in the 51–60-year group.[15] Endow et al. found that among 829 presumptive pulmonary tuberculosis patients, rifampicin resistance was detected in 7 cases (3.39%), and no rifampicin-resistant cases were reported in participants younger than 20 years of age.16 These studies demonstrate reduced rifampicin resistance in older adult males and its absence in younger age groups, supporting our finding of lower resistance outside the primary adult age bands.

In our study, among female patients, rifampicin-resistant tuberculosis was most common in middle-aged adults, followed by younger age groups, with very few cases in older adolescents and older adults, and none in the extreme age categories. Likewise, Reddy et al. found that in the Visakhapatnam CBNAAT study of 780 patients, rifampicin resistance was detected in 35 cases (4.3%), with peak occurrence in the 21–30 and 41–50-year age groups (11 cases each, 31.4%).[13] Gautam et al. found that in a study, rifampicin resistance was detected in 44 of 168 tuberculosis cases (26.1%), with females contributing to 6 cases (13.6%). Resistance was highest in the 20–40-year age group (25 cases, 36.7%).[17] These studies show that female rifampicin resistance is concentrated in adult age groups, with minimal cases at age extremes, supporting our observation of middle-aged predominance and lesser resistance rates in younger and older females.

Limitations

This retrospective, single-centre study relied on routine records, which limited data completeness and generalisability. Socioeconomic and behavioural risk factors were not available. Only rifampicin resistance was assessed without evaluating resistance to other anti-tuberculosis drugs.

CONCLUSION

Rifampicin-resistant tuberculosis is not evenly distributed across age and sex. Men were more affected than women, and most resistant cases were observed in adults between 41 and 50 years, followed by younger adults. Very few cases were observed in children and older individuals. These findings suggest that the economically productive age group was mostly affected by resistance. Early diagnosis and routine resistance testing in these age groups may help reduce the transmission. Further studies from multiple centres with detailed clinical and social data are needed to understand the contributing factors and improve prevention strategies.

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