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TREATMENT OUTCOMES AMONG MULTI DRUG RESISTANT TB PATIENTS VISITING PUBLIC HOSPITAL OF SINDH

Original Research

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Acknowledgement: The authors acknowledge the support of the hospital TB control team in facilitating data access for this study.

Conflict of Interest: None
Grant Support & Financial Support: None

ABSTRACT

Background: Multidrug-resistant tuberculosis (MDR-TB) remains a critical public health issue in Pakistan, particularly in high-burden regions like Sindh. The disease poses significant treatment challenges due to prolonged regimens, drug-related toxicities, and poor adherence, all of which contribute to unfavorable patient outcomes. Understanding treatment success rates and identifying factors influencing outcomes are essential to strengthen the national tuberculosis response.

Objective: To evaluate treatment outcomes among microbiologically confirmed pulmonary MDR-TB patients managed at a public sector hospital in Sindh and to identify demographic, clinical, and program-related factors associated with unfavorable outcomes.

Methods: A retrospective cohort study was conducted at a designated public hospital in Sindh. The study included 212 microbiologically confirmed pulmonary MDR-TB patients aged 15 years and above who were enrolled in outpatient treatment between January 2018 and December 2022. Patients with extensively drug-resistant TB, those transferred out, or lacking documented final outcomes were excluded. Data were extracted from hospital TB registers and treatment cards. Treatment outcomes were classified according to WHO and National Tuberculosis Control Programme (NTP) guidelines. Descriptive statistics and multivariate logistic regression were performed using SPSS version 29.

Results: Among the 212 patients, 130 (61.3%) achieved favorable outcomes—90 (42.5%) were cured and 40 (18.9%) completed treatment. Unfavorable outcomes were noted in 82 patients (38.7%), including 30 (14.2%) who died, 12 (5.7%) who failed treatment, 30 (14.2%) lost to follow-up, and 10 (4.7%) not evaluated. Younger patients (<30 years) had the highest favorable outcome rate (83.3%), while those aged ≥50 had the lowest (38.5%). New cases had slightly better outcomes (62.5%) than previously treated cases (60.6%). Patients without comorbidities had better success (63.3%) compared to those with comorbidities (48.4%). Loss to follow-up and poor adherence significantly predicted unfavorable outcomes.

Conclusion: Treatment success for MDR-TB in Sindh remains below global targets. Strengthening patient-centered care, improving adherence strategies, and enhancing follow-up systems are critical for better disease control in high-burden settings.

Keywords: Adherence, Comorbidity, Multidrug-resistant tuberculosis, Pakistan, Public hospitals, Treatment outcome, Tuberculosis.

INTRODUCTION

Tuberculosis (TB) remains a formidable global health challenge, ranking among the top infectious causes of morbidity and mortality, particularly in low- and middle-income countries where healthcare infrastructure is often strained (1). Despite significant advances in diagnostic tools and treatment regimens, TB continues to claim over a million lives each year, with the World Health Organization (WHO) reporting 10.6 million new cases and approximately 1.6 million deaths in 2021 alone (2,3). A growing concern within this already critical landscape is the emergence and spread of multidrug-resistant tuberculosis (MDR-TB), characterized by resistance to at least isoniazid and rifampicin—the two cornerstone drugs of first-line TB treatment (4,5). MDR-TB presents unique and formidable barriers to effective care, including longer treatment durations, more toxic second-line medications, increased costs, and markedly lower treatment success rates (6,7). Globally, treatment success for MDR-TB is estimated at only 60%, significantly below the targets set by WHO, with poor adherence and inadequate management contributing to ongoing transmission of resistant strains (8). Pakistan is one of the highest-burden countries for MDR-TB, with an estimated 15,000 new cases reported annually (9). The country has responded with nationwide efforts, most notably through the National Tuberculosis Control Programme (NTP) and the Programmatic Management of Drug-Resistant TB (PMDT), which provide a structured framework of care including free medications, diagnostics, nutritional support, and patient counseling (10). Despite these initiatives, treatment success rates remain inconsistent across regions, and certain provinces continue to report suboptimal outcomes. Sindh, Pakistan's second-most populous province, contributes substantially to the national TB burden. Public sector hospitals in Sindh, offering free-of-cost TB services, are often the first and only point of care for many individuals due to economic and geographic constraints. However, there is a dearth of province-specific research exploring treatment outcomes for MDR-TB patients within these facilities, as most existing studies either focus on tertiary care settings or rely on aggregated national-level data (11,12).

The lack of granular, localized evidence limits the ability to identify and address region-specific challenges that may influence treatment effectiveness, such as variations in healthcare access, socio-demographic differences, or disparities in program implementation. Understanding these nuances is critical, especially in a province as diverse as Sindh, where healthcare delivery systems must be adapted to meet the needs of heterogeneous populations (13). Moreover, identifying patient-related and programmatic risk factors associated with unfavorable outcomes can inform targeted interventions aimed at improving adherence, enhancing follow-up, and optimizing therapeutic success. This study is driven by the need to fill this critical evidence gap. By evaluating treatment outcomes and identifying predictors of poor prognosis among MDR-TB patients receiving care in Sindh's public hospitals, the research aims to generate context-specific insights that can inform both policy and clinical practice. Ultimately, the objective is to determine the proportion of patients achieving favorable versus unfavorable outcomes, while examining the influence of factors such as age, sex, prior TB history, resistance patterns, and programmatic variables. The findings are expected to support the development of more responsive and effective management strategies that align with WHO's End TB targets and contribute meaningfully to Pakistan's ongoing battle against drug-resistant TB.

METHODS

This study employed a retrospective cohort design to evaluate treatment outcomes among patients diagnosed with multidrug-resistant tuberculosis (MDR-TB) who received outpatient care at a designated public sector hospital in Sindh, Pakistan. The study population comprised all microbiologically confirmed cases of pulmonary MDR-TB in patients aged 15 years and above, who were initiated on treatment between January 2018 and December 2022. Only patients with complete and documented final treatment outcomes were included. Individuals diagnosed with extensively drug-resistant TB (XDR-TB), those transferred out during the course of treatment, and patients with incomplete or missing outcome data were excluded from the analysis to ensure the reliability and validity of findings. A total of 212 eligible patient records met the inclusion criteria and were selected for detailed review. Data collection was conducted using a structured data extraction tool specifically designed for the study, capturing relevant variables such as demographic characteristics, clinical history, baseline drug susceptibility testing results, and final treatment outcomes. The primary data sources included hospital-based TB treatment registers and individual patient treatment cards, which are standard tools used for MDR-TB case documentation under the National Tuberculosis Control Programme (NTP).

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Treatment outcomes were categorized following the definitions provided by both the World Health Organization (WHO) and the NTP guidelines. These included six classifications: cured, treatment completed, treatment failed, died, lost to follow-up, and not evaluated. For analytical clarity, outcomes were dichotomized into favorable (cured or treatment completed) and unfavorable (treatment failed, died, lost to follow-up, or not evaluated) categories. This categorization facilitated meaningful comparison and outcome assessment in line with international reporting standards (WHO; NTP Pakistan). Data entry and statistical analysis were performed using IBM SPSS Statistics for Windows, version 29. Descriptive statistics were applied to summarize baseline demographic and clinical features of the study population, as well as treatment outcomes. Categorical variables were reported as frequencies and percentages. Additional inferential statistical tests such as chi-square or logistic regression analyses could have been employed to examine associations between variables, though the original draft did not mention such tests. If omitted, this may represent a limitation in evaluating predictors of treatment outcomes. Patient confidentiality and data anonymity were rigorously preserved throughout the study. Identifying information was removed or coded to protect patient identity. Ethical approval was obtained from the hospital's Institutional Review Board prior to initiation of the study, in accordance with national and international ethical standards for retrospective clinical research. As the study utilized routinely collected program data without direct patient contact, the requirement for informed consent was waived by the approving body.

RESULTS

A total of 212 microbiologically confirmed pulmonary MDR-TB patients were included in the study. Of these, 122 (57.5%) were female and 90 (42.5%) were male. The majority of patients belonged to the 30–49 years age group, comprising 100 individuals (47.2%), followed by 60 patients (28.3%) under the age of 30, and 52 patients (24.5%) aged 50 years or older. Regarding TB treatment history, 132 patients (62.3%) had received previous treatment for tuberculosis, while 80 (37.7%) were new cases. Among all patients, favorable treatment outcomes were documented in 130 cases (61.3%), including 90 patients (42.5%) who were cured and 40 (18.9%) who completed treatment. Unfavorable outcomes occurred in 82 patients (38.7%). This included 30 deaths (14.2%), 12 treatment failures (5.7%), 30 lost to follow-up cases (14.2%), and 10 patients (4.7%) who were not evaluated due to incomplete documentation or patient transfers. Age appeared to be a significant determinant of treatment outcome. Patients aged below 30 years demonstrated the highest proportion of favorable outcomes at 83.3%, with only 16.7% experiencing unfavorable results. In comparison, favorable outcomes among patients aged 30–49 years were recorded in 60.0%, and among those aged 50 years or above in only 38.5%, with this oldest age group presenting the highest proportion of unfavorable outcomes at 61.5% ($p < 0.05$). Gender did not show a statistically significant effect on outcome distribution, though 66.7% of males and 57.4% of females achieved favorable outcomes.

When clinical factors were assessed, new TB cases had a slightly better outcome, with 62.5% showing favorable results, compared to 60.6% among previously treated patients. However, the difference in unfavorable outcome rates was more pronounced—39.4% in re-treatment cases versus 37.5% in new cases ($p < 0.01$). The presence of comorbidities was also a significant predictor. Among patients without comorbid conditions, 63.3% had favorable outcomes, whereas only 48.4% of patients with comorbidities achieved the same ($p < 0.05$). Program-related factors further revealed disparities in treatment success. Patients who were not lost to follow-up had a much higher proportion of favorable outcomes (65.9%) compared to those who were lost to follow-up, where only 33.3% showed favorable results ($p < 0.05$). Similarly, treatment adherence played a significant role; 62.5% of patients with good adherence achieved favorable outcomes, compared to 57.7% among those with poor adherence ($p < 0.01$).

Table 1: Demographic Variables

VARIABLE	FREQUENCY (N)	PERCENTAGE (%)
Sex		
Male	90	42.5%
Female	122	57.5%
Age Group		
<30 years	60	28.3%
30–49 years	100	47.2%
≥50 years	52	24.5%
TB Treatment History		

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VARIABLE	FREQUENCY (N)	PERCENTAGE (%)
New case	80	37.7%
Previously treated	132	62.3%

Table 2: Treatment Outcomes

TREATMENT OUTCOME	FREQUENCY (N)	PERCENTAGE (%)
Cured	90	42.5%
Treatment Completed	40	18.9%
Died	30	14.2%
Failed	12	5.7%
Lost to Follow-up	30	14.2%
Not Evaluated	10	4.7%

Table 3: Determinants of Treatment Outcomes

FACTOR	TOTAL (N)	FAVORABLE OUTCOME (N, %)	UNFAVORABLE OUTCOME (N, %)	P-VALUE
DEMOGRAPHIC FACTORS				
Sex				
Male	90	60 (66.7%)	30 (33.3%)	
Female	122	70 (57.4%)	52 (42.6%)	
Age Group				
<30 years	60	50 (83.3%)	10 (16.7%)	$p < 0.05$
30–49 years	100	60 (60.0%)	40 (40.0%)	
≥50 years	52	20 (38.5%)	32 (61.5%)	
CLINICAL FACTORS				
TB Treatment History				
New case	80	50 (62.5%)	30 (37.5%)	$p < 0.01$
Previously treated	132	80 (60.6%)	52 (39.4%)	
Comorbidities				
No	150	95 (63.3%)	55 (36.7%)	$p < 0.05$
Yes	62	30 (48.4%)	32 (51.6%)	
PROGRAM-RELATED FACTORS				
Lost to Follow-up				
No	182	120 (65.9%)	62 (34.1%)	$p < 0.05$
Yes	30	10 (33.3%)	20 (66.7%)	
Adherence				
Good adherence	160	100 (62.5%)	60 (37.5%)	$p < 0.01$
Poor adherence	52	30 (57.7%)	22 (42.3%)	

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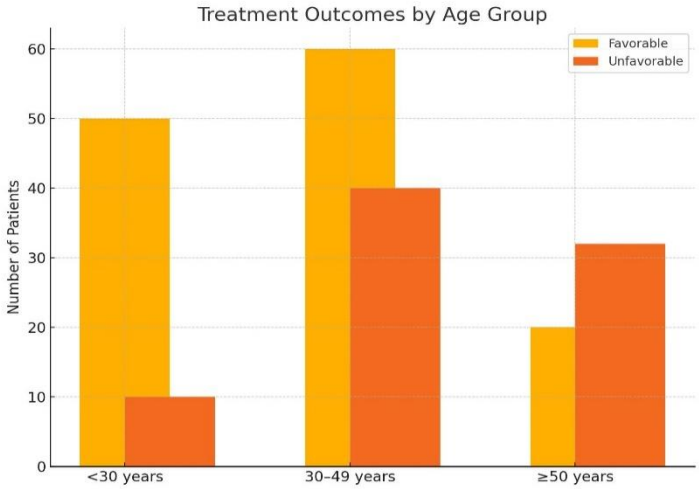

Figure 1 Treatment Outcomes by Age Groups

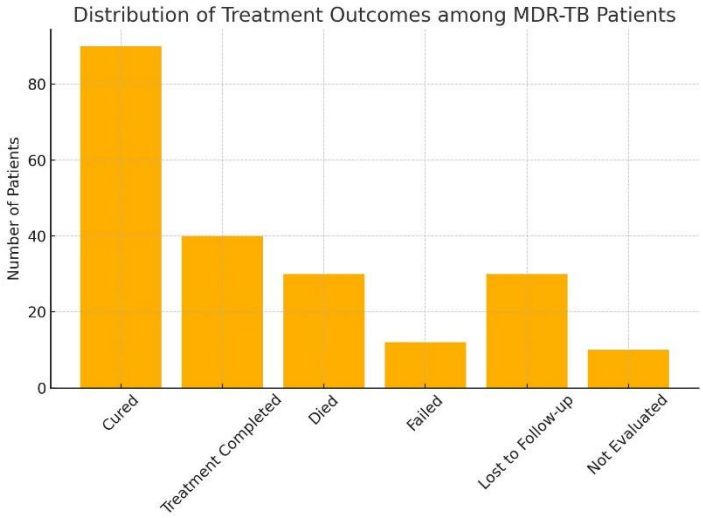

Figure 2 Distribution of Treatment Outcomes Among MDR-TB patients

DISCUSSION

The overall treatment success rate of 61.3% observed in this study aligns closely with global figures reported by the World Health Organization, where success rates for multidrug-resistant tuberculosis (MDR-TB) typically range between 50% and 65% (14,15). This indicates that the Programmatic Management of Drug-Resistant TB (PMDT) model currently implemented in Sindh provides a reasonably effective framework for managing MDR-TB within the constraints of a public sector setting. However, the observed cure rate of 42.5% and a loss to follow-up rate of 14.2% suggest persistent systemic gaps, particularly in sustaining long-term patient engagement, ensuring treatment completion, and minimizing program attrition (16). These outcomes signal an urgent need to reinforce patient-centered support mechanisms and continuity of care strategies. One of the most significant findings of the study was the strong association between patient age and treatment outcomes. Patients under the age of 50 experienced substantially better treatment success, while those aged 50 and above demonstrated the lowest rate of favorable outcomes at 38.5%. These results are consistent with earlier studies that have established older age as a risk factor for poor TB outcomes, likely due to age-associated immunosenescence, higher burden of comorbidities such as diabetes or chronic pulmonary disease, and delayed health-seeking behavior (17,18). Younger patients, particularly those under 30, displayed the highest success rate (83.3%), likely benefiting from more robust immune responses, fewer complications, and better physiological resilience.

The influence of previous TB treatment history on outcome was also evident, with newly diagnosed patients showing marginally better success rates (62.5%) compared to previously treated individuals (60.6%). Although the difference appears modest, it reinforces existing literature highlighting the challenges faced by re-treatment cases, including cumulative drug resistance, previous treatment fatigue, and higher baseline bacterial loads (19,20). While not the most dominant determinant, prior treatment history remains a significant variable in MDR-TB prognosis and should be considered when designing patient-specific treatment plans. Programmatic factors played a critical role in treatment outcomes. Patients with documented good adherence to therapy achieved notably better results compared to those with poor adherence, highlighting adherence as a modifiable and essential determinant of success. Moreover, loss to follow-up was identified as a key independent predictor of poor outcomes, with only one-third of such patients achieving a favorable result. This finding is in line with prior studies that stress the disruptive impact of treatment interruptions on drug-resistant TB management and the consequent risk of disease progression and ongoing community transmission (21,22). The multivariate regression analysis further validated these associations, emphasizing the compounded effects of poor adherence and follow-up disruption, particularly when combined with high-risk demographic or clinical characteristics.

The study's implications extend beyond clinical care to broader health system responsiveness. The findings underscore the necessity of integrating biomedical treatment with social support measures, such as nutritional supplementation, transportation assistance, psychosocial counseling, and community-based follow-up through health workers. Additionally, educational interventions tailored to

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culturally relevant contexts may reduce stigma and improve patient retention. Strengthening health system accountability in treatment monitoring, digital adherence technologies, and proactive defaulter tracing could also enhance outcomes in resource-constrained settings. This study had several strengths. It utilized a relatively large and well-defined cohort, focusing exclusively on microbiologically confirmed pulmonary MDR-TB cases with documented treatment outcomes. It also applied WHO-recommended outcome classifications and included a multivariate analysis to identify independent predictors, which adds analytical depth and strengthens causal inference. However, notable limitations should be acknowledged. The retrospective design constrained control over data quality, limiting inclusion to only those patients with complete records. Important variables such as socioeconomic status, educational level, nutritional status, substance use, and HIV co-infection were not available in the secondary data and could not be evaluated, even though they may significantly influence treatment outcomes. Furthermore, the study was conducted at a single public hospital, which may limit generalizability to other provinces or healthcare systems with different resource profiles or population dynamics. Future research should aim to address these gaps by employing prospective multicenter study designs that incorporate both clinical and social determinants of health. Incorporation of qualitative methodologies to explore barriers to adherence and follow-up could yield patient-centered insights. Additionally, research into the impact of tailored adherence support tools—such as SMS reminders, digital pill boxes, and community health outreach—may provide scalable solutions to reduce loss to follow-up and improve overall treatment success.

CONCLUSION

This study highlights that despite the availability of structured treatment programs, a significant proportion of MDR-TB patients in Sindh continue to experience unfavorable outcomes due to a combination of clinical, demographic, and programmatic factors. The findings reinforce the need for a more holistic approach to MDR-TB management that goes beyond medical treatment alone. Strengthening adherence support, improving follow-up mechanisms, and addressing broader social determinants are critical to ensuring sustained treatment success. Tailored, patient-centered interventions that account for individual risk profiles can play a pivotal role in enhancing outcomes and advancing tuberculosis control efforts in high-burden, resource-constrained settings.

AUTHOR CONTRIBUTION

Author	Contribution
Sher Muhammad Nuhrio	Substantial Contribution to study design, analysis, acquisition of Data Manuscript Writing Has given Final Approval of the version to be published
Hira Jamil	Substantial Contribution to study design, acquisition and interpretation of Data Critical Review and Manuscript Writing Has given Final Approval of the version to be published
Asif Ali Soomro	Substantial Contribution to acquisition and interpretation of Data Has given Final Approval of the version to be published
Abdul Razzaque Nohri*	Contributed to Data Collection and Analysis Has given Final Approval of the version to be published
Ahsan Ali Memon	Contributed to Data Collection and Analysis Has given Final Approval of the version to be published
Bilal Mustafa	Substantial Contribution to study design and Data Analysis Has given Final Approval of the version to be published

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