



INFORMASI ARTIKEL

Received: January, 3, 2025

Revised: January, 4, 2026

Available: January, 4, 2026

at : <https://e-jurnal.iphorr.com/index.php/qlt>

Overview of treatment success with short, long, and BPaL/M regimens in patients with drug resistant tuberculosis

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Abstract

Background: Drug-resistant tuberculosis (DR-TB) remains a major challenge in global TB control efforts, particularly in middle-income countries such as Indonesia. Long-term regimens lasting 18–24 months have been associated with low treatment success rates due to their prolonged duration and high incidence of adverse drug reactions. More recent developments, namely the bedaquiline–pretomanid–linezolid regimen with or without moxifloxacin (BPaL/M), have demonstrated treatment success rates of up to 89–90% in international clinical trials.

Purpose: To describe the treatment success of short-term, long-term, and BPaL/M regimens among patients with drug-resistant tuberculosis.

Method: A retrospective descriptive study was conducted using medical record data of DR-TB patients who received long-term, short-term, or BPaL/M regimens during 2023–2024. Treatment outcome classification followed the WHO 2022 guidelines. The variables collected included patient characteristics, type of regimen, and treatment outcomes based on WHO standards: cured, treatment completed, treatment failed, lost to follow-up, and died.

Results: Of the 148 DR-TB patients who met the inclusion criteria, 98 patients (66.2%) received long-term regimens, 17 patients (11.5%) received short-term regimens, and 33 patients (22.3%) were treated with the BPaL/M regimen. The treatment success rate (cured + treatment completed) for the short-term regimen was 76.5%, which was lower compared to the long-term regimen at 83.7%. The BPaL/M regimen demonstrated the highest treatment success rate at 87.9%.

Conclusion: The treatment success rates for DR-TB patients at Dr. H. Abdul Moeloek Hospital indicate that the BPaL/M regimen provides the most favorable outcomes compared to long-term and short-term regimens.

Keywords: BPaL/M Regimen; Drug-Resistant Tuberculosis; Long-Term Regimen; Short-Term Regimen; Treatment Success.

INTRODUCTION

Drug-resistant tuberculosis (DR-TB), including multidrug-resistant TB (MDR-TB) and rifampicin-resistant TB (RR-TB), remains a major challenge for global TB control programs (World Health Organization, 2023). Drug resistance emerges when *Mycobacterium tuberculosis* strains are no longer

susceptible to first-line antituberculosis drugs (isoniazid and rifampicin), rendering the standard 6-month regimen for drug-sensitive TB ineffective (Elisa, Setiabudi, & Dwiyan, 2023). Over the past several years, various therapeutic approaches have been developed to address DR-TB, including shorter

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treatment regimens, longer conventional regimens, and the most recent regimens based on modern drug combinations such as BPaL/M (Bedaquiline, Pretomanid, Linezolid, and Moxifloxacin) (World Health Organization, 2022).

Multiple studies have shown promising outcomes for these regimens. Recent clinical trials demonstrated for instance, that the 6-month BPaL/M regimen achieved significantly higher treatment success rates than conventional regimens, reaching 89%. Real-world evidence also reports high levels of success for example, among cohorts of MDR/RR-TB and pre-XDR TB patients treated with BPaL-based regimens, an overall success rate of 93.6% has been documented (World Health Organization, 2023).

However, direct comparative data between shorter regimens, longer regimens, and BPaL/M regimens among DR-TB populations—especially within national or local contexts such as Indonesia—remain limited. Variables such as demographic characteristics, resistance profiles, drug availability, and treatment adherence differ across settings, making it difficult to generalize findings universally (Vanino, Battagin, Fregonese, & Dara, 2023).

DR-TB In Indonesia continues to pose a significant public health burden, particularly in provinces with high TB prevalence such as Lampung. National reports indicate that DR-TB treatment success varies widely across healthcare facilities and is influenced by medication availability, access to care, and patients' adherence to treatment (Ministry of Health Republic of Indonesia, 2023). Dr. H. Abdul Moeloek Hospital, as the provincial referral center, plays a critical role in DR-TB management in Lampung. The diversity of patient profiles, sociodemographic conditions, and facility resources highlights the importance of evaluating the treatment success of different DR-TB regimens in this hospital as a basis for strengthening TB services. To date, however, comparative data on the effectiveness of shorter regimens, longer regimens, and BPaL/M regimens in this setting remain limited.

RESEARCH METHODOLOGY

This study uses a quantitative descriptive approach, aiming to describe the factors associated with the treatment outcomes of drug-resistant tuberculosis (TB-RO) patients who received short-term, long-term, or BPaL/M regimens. The focus of the research is to explore demographic, clinical, and therapeutic characteristics that influence the effectiveness of TB-RO treatment, based on the WHO drug-resistant TB treatment framework and the national TB management guidelines.

The research was conducted at RSUD Dr. H. Abdul Moeloek Lampung Province as the main referral hospital for TB-RO management in Lampung Province. The study period covered medical records of patients treated between January 2023-December 2024. The sample consisted of TB-RO patients who had undergone treatment using short-term regimens, long-term regimens, or BPaL/M regimens, with complete documentation of treatment outcomes in their medical records.

The sampling technique was purposive sampling, with inclusion criteria: patients diagnosed with drug resistant tuberculosis and having complete information on the treatment regimen and final outcomes. Exclusion criteria included patients with incomplete treatment outcome data, patients transferred out without documented final outcomes, or duplicate medical records. Data were collected through a systematic review of medical records and supporting documents from the hospital's TB program unit. The extracted data were analyzed descriptively to describe the distribution of treatment regimens used and the proportions of final treatment outcomes among DR-TB patients.

This research has obtained ethical approval from the Health Research Ethics Committee of RSUD Dr. H. Abdul Moeloek, based on Decree Number: 616/KEPK-RSUDAM/X/2025. All data were anonymized, confidentiality of patient identity was strictly maintained, and the use of medical records followed ethical guidelines for secondary data research.

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DOI: <https://doi.org/10.56922/quilt.v6i1.2220>

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RESEARCH RESULT

Table 1. Distribution of Treatment Regimens Used Among Drug-Resistant Tuberculosis Patients (N=148)

Variable	Results
Treatment Regimen (n/%)	
Short-term	17/11.5
Long term	98/66.2
BPAL/M	33/22.3
Treatment Results (n/%)	
Success	124/83.8
Unsuccess	24/16.2

The data showed that the majority of drug-resistant tuberculosis patients received the long-term regimen (66.2%). During the 2023–2024 period, long-term regimens were still widely used, particularly for patients who did not meet the eligibility criteria for shorter or BPAL/M regimens, such as those with complex resistance patterns or significant comorbidities.

Meanwhile, 22.3% of patients received the BPAL/M regimen, reflecting the increasing adoption of newer all-oral regimens following national guidance that supports their use for eligible DR-TB patients. The proportion indicates that the BPAL/M regimen has begun to be integrated into routine clinical practice at the hospital during this period.

Only 11.5% of patients received the short-term regimen. The low proportion may be associated with clinical eligibility factors, as short-term regimens require specific conditions such as limited resistance profiles and adequate tolerance. This suggests that, despite being part of national recommendations, short-term regimens were used selectively for patients meeting strict criteria.

Overall, the distribution of regimens in 2023–2024 indicates that long-term regimens remained dominant, while the use of BPAL/M increased as part of ongoing updates in DR-TB management aligned with global and national guidelines.

The data showed that most drug-resistant tuberculosis patients at Dr. H. Abdul Moeloek Hospital achieved successful treatment outcomes, accounting for 83.8% of all cases. This high proportion of treatment success indicates that the majority of patients responded well to the regimens provided during the 2023–2024 treatment period. According to the WHO framework for DR-TB management, treatment success reflects effective regimen selection, adherence support, and adequate monitoring, which may also indicate good programmatic performance at the hospital.

Meanwhile, 16.2% of patients experienced unsuccessful outcomes, which include treatment failure, loss to follow-up, or death. Unsuccessful outcomes in DR-TB cases are often associated with factors such as advanced disease severity, comorbidities, drug toxicity, or challenges in maintaining treatment adherence. The presence of unsuccessful outcomes in this proportion suggests that despite overall success, there remain clinical and programmatic challenges that require further attention to ensure optimal outcomes for all patients. Overall, the distribution of treatment results indicates that the TB-RO management program is functioning effectively, though targeted interventions may still be needed for patients at higher risk of unfavorable outcomes.

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DISCUSSION

This study describes the distribution of treatment regimens and outcomes among Drug-Resistant Tuberculosis (DR-TB) patients. The findings provide evidence on how different therapeutic regimens are associated with treatment success or failure.

The treatment regimens used for DR-TB patients in this study consisted of short-term regimens, long-term regimens, and the BPAL/M regimen, all of which follow national and international recommendations for drug-resistant tuberculosis therapy (World Health Organization, 2022). Short-term regimens are designed to shorten treatment duration to 9–12 months and are recommended for patients who meet specific eligibility criteria based on drug-susceptibility testing (Ministry of Health Republic of Indonesia, 2023). Long-term regimens remain necessary for patients who present with more complex resistance patterns or who are not eligible for shorter treatment options (World Health Organization, 2020). The BPAL/M regimen represents a newer option consisting of bedaquiline, pretomanid, linezolid, and moxifloxacin that provides an all-oral, shorter, and more effective therapy for patients with highly resistant TB (Conradie, Diacon, Ngubane, Howell, Everitt, & Crook, 2020). The distribution of regimen use in this study reflects hospital efforts to select the most appropriate regimen according to clinical assessment, drug resistance patterns, and guideline-based criteria (Ministry of Health Republic of Indonesia, 2023).

The treatment outcomes observed in this study provide an important overview of the effectiveness of drug-resistant tuberculosis (DR-TB) therapy during the 2023–2024 period. The overall success rate of 83.8% indicates that most patients were able to complete treatment and achieve favorable clinical results, reflecting the adequacy of regimen selection and clinical management within the hospital's DR-TB program (World Health Organization, 2022). This percentage is notably higher than the global average DR-TB treatment success rate, which is reported to be approximately 60%, highlighting the strong performance of the treatment facility (World Health Organization, 2022).

The unsuccessful outcome rate of 16.2% includes patients who experienced clinical deterioration, treatment discontinuation, or death,

which is consistent with the challenges commonly encountered in DR-TB treatment programs, especially due to drug toxicity, pill burden, and prolonged treatment duration (Meressa, Hurtado, Andrews, Diro, Abato, Daniel, 2015). Treatment failure in DR-TB patients is frequently linked to adverse drug reactions, inadequate adherence, and delays in adjusting therapy according to drug susceptibility testing results (Singh, Dwivedi, Gaharwar, Meena, Rajamani, & Prasad, 2020). These findings underscore the importance of timely clinical monitoring and supportive supervision throughout treatment to minimize unsuccessful outcomes (Dalton, Cegielski, Akksilp, Asencios, Campos Caoili, & Cho, 2017).

Overall, the treatment outcomes in this study demonstrate that the hospital has effectively implemented recommended DR-TB treatment standards, although continuous evaluation is needed to further reduce the proportion of unsuccessful outcomes (World Health Organization, 2020).

The descriptive analysis of regimen types and treatment outcomes suggests that the selection of therapeutic regimens plays a key role in determining patient recovery. Regimens with shorter duration and all-oral components—such as modern BPAL/BPaLM combinations—are widely documented as having higher success rates due to reduced toxicity, fewer injections, and improved patient adherence (Conradie et al., 2020). Shorter regimens generally facilitate better patient compliance because they minimize treatment fatigue, which has been identified as a major barrier in DR-TB therapy worldwide (Torrea, Martinez, & Carvalho, 2021).

In contrast, longer regimens, which typically involve a larger pill burden and potential use of injectable drugs, are associated with higher risks of treatment discontinuation and adverse events (Ahmad, Ahuja, Akkerman, Alffenaar, Anderson, & Baghaei, 2018). This aligns with global evidence stating that regimen complexity is directly correlated with treatment failure, particularly in patients with additional comorbidities or socioeconomic challenges (Du Cros, Khamraev, Tigay, & Cooke, 2021). As such, the presence of unsuccessful outcomes in this study may in part be attributed to

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the use of longer or more toxic regimens, which inherently carry a greater risk of intolerance and non-adherence (Pontali, D'Ambrosio, Centis, Sotgiu, & Migliori, 2019).

Although statistical testing was not conducted in this study, the trend observed is consistent with findings in international literature, which show that all-oral shorter regimens significantly increase the likelihood of treatment success by enhancing tolerability and reducing patient burden (World Health Organization, 2022). This descriptive association supports the continued transition toward shorter, simplified, and all-oral DR-TB regimens as recommended by global TB treatment guidelines (World Health Organization, 2022).

The findings emphasize the importance of choosing regimens according to drug susceptibility testing results and patient eligibility. Hospitals should continue to optimize the use of effective all-oral regimens when possible and maintain strict monitoring to detect side effects early. These approaches may further increase the treatment success rate and reduce the risk of treatment failure.

This study is limited to descriptive data on regimen types and treatment outcomes without including other influencing factors such as adherence, comorbidities, or adverse effects. The analysis is also limited to one hospital, making it less generalizable to other regions.

This study contributes to documenting the real-world treatment outcomes of DR-TB patients based solely on regimen distribution during 2023–2024. These findings can serve as a reference for evaluating regimen effectiveness and for improving treatment policies at the hospital and regional levels.

CONCLUSION

This study provides an overview of the treatment outcomes of drug-resistant tuberculosis (DR-TB) patients at Dr. H. Abdul Moeloek Hospital based on the types of regimens used during the 2023–2024 period. The findings show that treatment success was generally higher among patients who received shorter or all-oral regimens, reflecting better tolerability, and adherence compared to longer treatment regimens. Conversely, unsuccessful outcomes such as treatment failure, loss to follow-

up, or death were more frequently observed in patients receiving longer or more complex regimens.

The descriptive association between regimen type and treatment outcome indicates that regimen selection plays a meaningful role in determining the likelihood of treatment success. These results highlight the importance of optimizing regimen choice according to updated national and international DR-TB guidelines to improve treatment effectiveness and reduce unsuccessful outcomes.

Overall, this study emphasizes the need for continued evaluation of regimen implementation and the strengthening of clinical monitoring to ensure that DR-TB patients receive the most effective and patient-friendly therapeutic options available. The content of the conclusion is a formulation of the answers to the research objectives, not a summary of the results study.

SUGGESTION

Future research is recommended to involve a larger number of DR-TB patients and extend the study period to obtain a more comprehensive overview of treatment outcomes across different regimen types. Further studies should also consider incorporating additional clinical variables such as comorbidities, drug-resistance patterns, and adherence profiles to better understand factors contributing to treatment success or failure. In addition, analytical methods such as regression or comparative statistical tests are suggested to strengthen evidence regarding the association between regimen type and treatment outcomes. Broader multisite studies are also encouraged to improve the generalizability of findings and provide stronger support for optimizing DR-TB treatment regimens in various healthcare settings.

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