

Factors Associated with Unsuccessful Treatment Outcomes Among Tuberculosis Patients in the North-East District of Penang, 2019-2023

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Introduction

Tuberculosis (TB) treatment outcomes in Malaysia have persistently exceeded the World Health Organisation's (WHO) recommended threshold of 10% for unsuccessful outcomes. This poses serious public health challenges, including increased TB transmission, drug resistance, and elevated morbidity and mortality. Prior research shows that patients with lower socioeconomic status, comorbidities, or severe disease presentations have a higher risk of unsuccessful treatment outcomes. However, most of these studies were conducted before the COVID-19 pandemic, and predominantly in high TB burden countries outside Malaysia. In Penang, no updated local data are available.

Method

This study aimed to identify factors associated with unsuccessful TB treatment outcomes in the North-East District of Penang. A retrospective cohort study was conducted using secondary data from the National Tuberculosis Registry. Universal sampling method is used, which includes all the TB patients registered in the district from 1 January 2019 until 31 December 2023. A total of 2,540 patients were initially included. After applying the exclusion criteria, the final study sample comprised 2,308 patients. The minimum sample size for the study is calculated to ensure an adequate and reliable sample. Sample size estimation was calculated using the two population proportions formula.

Independent variables included sociodemographic and clinical characteristics. Unsuccessful treatment outcomes were defined as all-cause mortality, loss to follow-up, and treatment failure. Data were analysed using SPSS version 26.0, with multiple logistic regression employed to identify factors associated with unsuccessful treatment outcomes.

Results

Among 2308 TB patients, 467 (20.23%) had unsuccessful outcomes: 340 (14.73%) deaths, 117 (5.07%) lost to follow-up, and 10 (0.43%) treatment failures. Unsuccessful treatment outcomes were significantly associated with older age (aOR=1.03, 95% CI=1.02, 1.04), male gender (aOR=1.74, 95% CI=1.35, 2.24), non-Chinese ethnicity (aOR=2.27, 95% CI=1.79, 2.89), and lower education level (aOR=2.00, 95% CI=1.43, 2.79). Clinically, higher risk of unsuccessful treatment outcome was observed among patients seeking hospital-based treatment (aOR=2.19, 95% CI=1.44, 3.35), presenting with weight loss (aOR=13.71, 95% CI=4.64, 40.48), HIV-positive status (aOR=8.22, 95% CI=4.36, 15.50), and moderate to advanced chest X-ray lesions during diagnosis (aOR=1.79, 95% CI=1.42, 2.26).

Discussion

These findings are consistent with previous studies. Older age and HIV co-infection likely reflect reduced immunity and higher mortality risk. Male sex is associated with greater risk-taking and poorer health-seeking behaviours. Lower education and non-Chinese ethnicity may indicate limited health literacy and suboptimal treatment adherence. Hospital-based cases tend to be more severe. Weight loss suggests malnutrition, potentially impairing drug absorption and efficacy. Moderate to advanced radiological lesions likely reflect delayed diagnosis and poorer prognosis.

Variables	Crude OR (95% CI)	p- value	Adjusted OR (95% CI)	p-value
Age in years	1.02 (1.02, 1.03)	<0.001	1.03 (1.02, 1.04)	< 0.001
Gender				
Male	1.91 (1.51, 2.42)	<0.001	1.74 (1.35, 2.24)	< 0.001
Female	1	-	1	-
Ethnicity				
Non-Chinese	1.43 (1.17, 1.75)	0.001	2.27 (1.79, 2.89)	<0.001
Chinese	1	-	1	-
Education level				
Lower (Secondary & below)	2.52 (1.84, 3.44)	<0.001	2.00 (1.43, 2.79)	<0.001
Higher (Tertiary & above)	1	-	1	-
Health facilities				
Hospital	1.97 (1.32, 2.94)	0.001	2.19 (1.44, 3.35)	<0.001
Clinic	1	-	1	-
Loss of weight				
Yes	14.72 (5.44, 39.86)	<0.001	13.71 (4.64, 40.48)	<0.001
No	1	-	1	-
HIV				
Positive	6.00 (3.36, 10.72)	<0.001	8.22 (4.36, 15.50)	<0.001
Negative	1	-	1	-
CXR				
Moderate, Advanced	1.88 (1.51, 2.33)	<0.001	1.79 (1.42, 2.26)	<0.001
No lesion / Not done / Minimal	1	-	1	-

Figure 1. Simple and multiple logistic regression

Conclusion

Unsuccessful TB treatment outcomes in the district are influenced by both sociodemographic and clinical factors. Tailored interventions targeting these high-risk groups are essential to enhance treatment success rates and contribute to achieving Malaysia’s end TB targets.

Keywords: Unsuccessful treatment outcomes, tuberculosis, multiple logistic regression

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