

A Clinical Prediction Model for Unsuccessful Pulmonary Tuberculosis Treatment Outcomes

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Abstract

Background

Despite widespread availability of curative therapy, tuberculosis (TB) treatment outcomes remain suboptimal. Clinical prediction models can inform treatment strategies to improve outcomes. Using baseline clinical data, we developed a prediction model for unsuccessful TB treatment outcome and evaluated the incremental value of human immunodeficiency virus (HIV)–related severity and isoniazid acetylase status.

Methods

Data originated from the Regional Prospective Observational Research for Tuberculosis Brazil cohort, which enrolled newly diagnosed TB patients in Brazil from 2015 through 2019. This analysis included participants with culture-confirmed, drug-susceptible pulmonary TB who started first-line anti-TB therapy and had ≥ 12 months of follow-up. The end point was unsuccessful TB treatment: composite of death, treatment failure, regimen switch, incomplete treatment, or not evaluated. Missing predictors were imputed. Predictors were chosen via bootstrapped backward selection. Discrimination and calibration were evaluated with c-statistics and calibration plots, respectively. Bootstrap internal validation estimated overfitting, and a shrinkage factor

was applied to improve out-of-sample prediction. Incremental value was evaluated with likelihood ratio-based measures.

Results

Of 944 participants, 191 (20%) had unsuccessful treatment outcomes. The final model included 7 baseline predictors: hemoglobin, HIV infection, drug use, diabetes, age, education, and tobacco use. The model demonstrated good discrimination (c-statistic = 0.77; 95% confidence interval, .73–.80) and was well calibrated (optimism-corrected intercept and slope, –0.12 and 0.89, respectively). HIV-related factors and isoniazid acetylation status did not improve prediction of the final model.

Conclusions

Using information readily available at treatment initiation, the prediction model performed well in this population. The findings may guide future work to allocate resources or inform targeted interventions for high-risk patients.

Keywords: [pulmonary tuberculosis](#), [prognosis](#), [prediction model](#), [epidemiologic research](#), [HIV coinfection](#)

Topic: [hiv](#), [diabetes mellitus](#), [pulmonary tuberculosis](#), [hemoglobin](#), [brazil](#), [calibration](#), [follow-up](#), [treatment failure](#), [tuberculosis](#), [treatment outcome](#), [drug usage](#), [tobacco use](#), [hiv infections](#), [clinical prediction rule](#), [imputation](#), [c statistic](#)

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