ABSTRACT

Compartmental Models of Tuberculosis in LMICs: A Scoping Review Mapping Model Types and Structures

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Background : Compartmental mathematical models are widely used to evaluate tuberculosis (TB) control strategies in low- and middle-income countries (LMICs), yet a systematic mapping of their types and structures remains limited.

Objective : To map the types and structures of TB compartmental models, their frequency of use, and the integration of programmatic components; as an additional analysis, to assess the alignment of included studies with the MODELS framework.

Research Methods/ Implementation Methods : This scoping review followed PRISMA-ScR using the PCC (Population, Concept, Context) framework. PubMed, Scopus, ScienceDirect, and EBSCO were searched for publications from 2020 to 2025, and data were synthesized descriptively and narratively.

Results : Of 2,981 articles identified, 14 studies met the inclusion criteria. SEIR-based structures and their extensions were most dominant (8 studies; 57.1%), while the other 6 studies used SIDTR, fractional, system dynamics, detection-treatment, vaccination, and integrated-intervention models. Model structures shifted from basic biological transmission dynamics toward programmatic components, including case detection, treatment failure, reinfection, drug resistance, and comorbidities. In the additional analysis, only 42.9% of studies fully met the Observed data and Examination steps of the MODELS framework.

Conclusion/Lesson Learned : TB compartmental models in LMICs are dominated by SEIR structures with increasingly complex programmatic variables. Use of local empirical data and formal model validation needs strengthening, and transparent methodological reporting is essential so that modeling results can become valid operational recommendations for TB control policy.

Keyword : Tuberculosis; compartmental model; SEIR; mathematical modeling; LMICs; case detection; treatment failure; vaccination; drug-resistant tuberculosis