

A Model for Tuberculosis with Endogenous Reactivation and Exogenous Reinfection

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Endogenous infection and exogenous reinfection are two mechanisms responsible for the reactivation or regeneration of active tuberculosis (TB) in individuals who have experienced prior active TB infections. Following primary TB infection, only approximately %10 of individuals develop active T.B. Most people are assumed to mount an effective immune response to the initial infection that limits proliferation of the bacilli and leads to long-lasting partial immunity both to further infection and to reactivation of latent bacilli remaining from the original infection. Infected individuals may develop active TB as a consequence of exogenous reinfection, i. e., acquiring a new infection from another infectious individual [?, ?].

In this paper, we propose a new model of tuberculosis with endogenous reactivation and exogenous reinfection. The analysis reveals that the model undergoes a backward bifurcation, where a stable disease-free equilibrium (DFE) co-exists with a stable endemic equilibrium when the associated reproduction threshold \mathcal{R} is less than unity. This phenomenon resulted due to the exogenous reinfection property of TB disease. It is shown that, in the absence of such reinfection, the model has a globally-asymptotically stable DFE when \mathcal{R} is less than unity. Numerical results are provided to illustrate theoretical results.

References

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