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Transmission and Dynamics of *Tuberculosis* with exogenous reinfection

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It is known that once infected with *Mycobacterium tuberculosis (MTB)*, individuals can either develop active *Tuberculosis (TB)* or remain infected for the rest of their life; unless endogenous reactivation or exogenous reinfection occurs. The epidemiological effects of control strategies (i.e., vaccination and drug treatment) in individuals with endogenous reactivation and exogenous reinfection are analysed using a mathematical model [2]. The model is structured as a homogeneous non-linear system of seven ordinary differential equations. Equilibrium analysis is performed in order to identify the steady states of the model. We also investigate the dependence of the number of equilibria and their stability, on the reproductive number of the disease. The results suggest that even if effective control strategies could have a significant effect on reducing *TB* transmission, the endogenous infection, due to mainly HIV infection, increases *TB* incidence. This fact shows an important role of the endogenous reactivation on epidemic of *TB*. Furthermore, we observe that exogenous reinfection may also play an important role in *TB* epidemics, because it is capable of sustaining *TB* even when the basic reproductive number $R_0 < 1$. Results show that beyond this threshold, the dynamics of the model are described by a backward bifurcation [1]. In particular, when reinfection is present R_0 does not accurately describe the severity of an epidemic. Finally, the results suggest that to reach the eradication of *TB* it would be necessary that all individuals were vaccinated with perfect vaccine.

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[1] M. Martcheva et. al., *J. Math. Biol.* **46**, 385-424 (2003).

[2] Z. Feng et. al. *Theoret. Population Biol.*, **57**(3), 235-247, (2000).