Optimal Control of Chemoprophylaxis and Treatment Tuberculosis Model

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Abstract

Tuberculosis (TB) is an infectious disease caused by Mycobacterium tuberculosis bacteria (Mtb) incomplete treatment can lead to relapse, but relapse can also occur in patients who took a full course of treatment and were declared cured.

In this final project a tuberculosis model which incorporates treatment of infectives and chemoprophylaxis is considered. For this model, controls on chemoprophylaxis ($u_1$), treatment ($u_2$), and disease relapse ($u_3$) are incorporated to reduce the latently infected and actively infected individual populations, via application of the Pontryagins Maximum Principle of optimal control theory. The result from numerical simulation shows that the total number of individuals latently infected and actively infected to TB with optimal chemoprophylaxis, treatment, and disease relapse is 0.0051 at time $t_f = 25$ (years), while the latently infected and actively infected individuals without controls is 2360.

Keywords: Tuberculosis, Optimal Control, Pontryagins Maximum Principle