

ANALYSIS OF TRANSMISSION DYNAMICS OF TUBERCULOSIS (TB) USING DIFFERENTIAL EQUATIONS: A CASE STUDY OF AMANSIE WEST DISTRICT, GHANAT

This paper is suitable for publication in British Journal of Mathematics & Computer Science if the authors implement the following corrections and other changes:

1. On page 1, line 13, "non - negative equilibria namely the disease - free equilibrium", should be written "non-negative equilibria namely the disease-free equilibrium".
2. On page 2, line 44, change "(Nicas et.al, 2005)" to "(Nicas et al., 2005)".
3. On page 3, line 73, change "W.H.O.," to "WHO,".
4. On page 8, line 205, the following statement:"The term $\frac{\beta SI}{N}$ is negative because the number of susceptible individuals decreases." is incorrect because S, I, N et β are positive.
5. On page 8, lines 212, 215 and 217 add '.' in the end of the three equations.
6. On page 9, line 219, change "was given as follows;" to "was given as follows:" and add '.' in the end of equations (1), (2) and (3). Add '.' in the end of equation (4).
7. On page 11, line 261, "The Basic Reproduction number", should be written "The basic reproduction number".
8. On page 14, write the characteristic equation about the point $(1, 0, 0)$ as follows:

$$(\mu + \lambda)[\lambda^2 + (2\mu + \epsilon + \gamma)\lambda + (\mu + \epsilon)(\mu + \gamma)(1 - R_0)] = 0, \quad (1)$$

where the roots are:

$$\begin{aligned}\lambda_1 &= -\mu, \\ \lambda_2 &= \frac{-(2\mu + \epsilon + \gamma) - \sqrt{(2\mu + \epsilon + \gamma)^2 - 4(\mu + \epsilon)(\mu + \gamma)(1 - R_0)}}{2}, \\ \lambda_3 &= \frac{-(2\mu + \epsilon + \gamma) + \sqrt{(2\mu + \epsilon + \gamma)^2 - 4(\mu + \epsilon)(\mu + \gamma)(1 - R_0)}}{2}.\end{aligned}$$

It is clear that λ_1 and λ_2 are negative. Moreover, λ_3 is negative when $R_0 < 1$ and it is positive when $R_0 > 1$. Hence, we deduce that:

- If $R_0 < 1$, then the disease-free equilibrium, $(1, 0, 0)$, is locally asymptotically stable.
- If $R_0 > 1$, then $(1, 0, 0)$ is unstable.

Add this proof in your paper.

9. Please add the following reasoning to show that the endemic steady state is locally asymptotically stable when $R_0 > 1$, because $b_1 > 1$, $b_3 > 1$ and

$$b_1 b_2 - b_3 = \mu R_0 (\epsilon + \mu)^2 + (\gamma + \mu + \mu R_0) b_2 + (\mu + \epsilon)(\mu + \gamma) > 0.$$

10. Include and comment in the Introduction a recent and related work: Optimal Control of Tuberculosis with Exogenous Reinfection, Applied Mathematical Sciences, Vol. 3, no. 5, (2009), 231–240.
11. On page 20, line 421, Ref (Saltelli et al., 2008) is not mentioned in the references.
12. On page 29, line 596, give exact data of Ref [3] by adding year, ...etc.