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Mathematical analysis of Transfusion–transmitted malaria model with optimal control

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An SIR (susceptible–infected–removed) mathematical model for the transmission dynamics of the transfusion–transmitted malaria model with optimal control pair and was developed and studied in this research work. The model transfusion–transmitted Malaria disease–free equilibrium and endemic equilibriums points were determined. It was shown that the disease–free equilibrium was locally asymptotically stable if the associated basic reproduction numbers is less than unity while the disease persists if is greater than unity. The global stability of the transfusion –transmitted malaria model at the disease – free equilibrium was established using the comparison method. The optimality system was derived and an optimal control model of drug treatment for the Transfusion–transmitted malaria model was investigated. Conditions for the optimal control were considered using Pontryagin's maximum principle and solve numerically using the forward and backward finite difference method (FBDM). The model exhibit two equilibria, disease-free and endemic equilibrium. The simulated optimal control pair controls the percentage effect of the drug on human and represents the efficiency of the drug treatment to curb the transfusion of the malaria from human to human. The characterized objective function based on maximizing human without malaria and minimizing the cost of transfusion–transmitted malaria treatment was in agreement with the existing literature. The numerical results obtained using (FBDM) was also in complete agreement with other literature. The optimality system is derived and solved numerically.

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