Modelling the impact of treatment on malaria and schistosomiasis co-infection

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Malaria infection continues to be a life threatening disease in many parts of the world and is the first deadly parasitic disease whereas schistosomiasis is the second to malaria. In this study a non-linear deterministic model for malaria-schistosomiasis co-infection has been formulated to investigate the impact of treatment on malaria and schistosomiasis. Malaria-schistosomiasis co-infection model is first considered, the model is then modified to incorporate the aspect of treatment. The sub-models of malaria and schistosomiasis are considered, followed by the co-infection model in the presence of treatment. Positivity and boundness of solutions are analysed qualitatively. The disease-free equilibrium is shown to be locally asymptotically stable when the allied epidemic threshold is less than unity. The centre Manifold theory is used to show malaria, schistosomiasis and Malaria-schistosomiasis endemic equilibria are locally asymptotically stable when the allied reproduction numbers are greater than unity. The basic reproduction number of malaria schistosomiasis R_{MC} is greater than the effective reproduction number for the malaria - schistosomiasis $R_{(MC)7}$ implying that treatment has a positive impact on eradication of infection from the community. Sensitivity indices of the basic reproduction number to the parameter are calculated. Reducing the biting rate of mosquitoes decreases the new number of cases for malaria where as an increase for the mortality for the snails decreases the number of new cases for schistosomiasis. Numerical simulations show that treatment has a positive impact on eradication of infection from the community. However, the combination of treatment and other control strategies will completely eradicate the infection from the community.