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Malaria is a life-threatening disease caused by parasites that are transmitted to people through the bites of infected mosquitoes, about half the world population is at risk of infection. In this paper, a deterministic model for malaria transmission, incorporating the re-infection of symptomatic individuals, a phenomenon known as superinfection is presented. Qualitative analysis of the model reveals the presence of backward bifurcation a phenomenon where stable disease free equilibrium co-exists with a stable endemic equilibrium when the associated reproduction threshold is less than unity. Optimal control theory is then applied to the model to study the time dependent treatment efforts to minimize the infected while keeping the implementation cost at a minimum. (Received September 08, 2010)