A mathematical model for the dynamics and control of river blindness with asymptomatic infected humans

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Onchocerciasis, also known as river blindness, is a disease caused by infection with SBS the parasitic worm Onchocerca volvulus and is transmitted to humans through exposure to repeated bites of infected blackflies of the genus Simulium. It is endemic mostly in remote and rural areas in sub-Saharan Africa. Community-directed annual mass drug administration (MDA) with ivermectin is the core to eliminate onchocerciasis in all endemic foci in Africa. However, novel and alternative strategies such as vaccination are urgently required to supplement elimination of the disease. In this study, a mathematical model with asymptomatic infected humans is formulated to assess the impact of the different control strategies. Model analysis is performed for the existence and stability of the equilibrium points. The next generation approach is used to calculate the basic reproduction number, Ro. The disease-free equilibrium (DFE) is locally asymptotically stable when Ro < 1. The study findings reveal that a combination of mass treatment s with ivermectin together with vaccination should be applied to eliminate the disease.

Keywords: Basic reproduction number; endemic; mass drug administration; onchonciasis; vaccination.