Impact of imported cases in the dynamics of malaria transmission in KwaZulu-Natal: A meta-population modelling

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Malaria is a vector-borne disease responsible for more than 600,000 deaths each year [1]. Although countries have taken steps to reduce the incidence of malaria, many regions remain endemic. In South Africa, malaria is mainly transmitted along the country's borders. Some of South Africa's nine provinces (Limpopo, Mpumalanga, and KwaZulu-Natal) are endemic for malaria, and 10% of the population (about 4.9 million people) are at risk of contracting the disease [2]. Efforts to eradicate malaria in these regions will be in vain if policies do not include neighboring countries. In this paper, we propose a metapopulation model of malaria that incorporates Transmission Blocking Drugs as a treatment, and random testing to identify asymptomatic individuals in the country and also at the border. The basic reproduction number of the model is evaluated and the local stability of the disease-free equilibrium is demonstrated. In the case of isolated patches, the existence of an endemic equilibrium is investigated. Sensitivity analysis allowed us to identify the most sensitive parameters of our model. The numerical simulations show that systematic detection of all asymptomatic cases at the border will help to eradicate malaria in the KwaZulu-Natal region.

Keywords: Malaria, metapopulation, sensitivity analysis, numerical simulations

References

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