

**Damian Kajunguri**, SACEMA, University of Stellenbosch, South Africa  
John W. Hargrove, SACEMA, University of Stellenbosch, South Africa

## **Cost-effectiveness analysis of tsetse and *Trypanosoma brucei rhodesiense* control through application of insecticides on cattle**

The control of African trypanosomiasis or sleeping sickness by using trypanocidal drugs has been frustrated by drug resistance in addition to being expensive for most people in sub-Saharan Africa. Hence, the need to control the disease by attacking its insect vectors, the tsetse flies (*Glossina ssp*) which can be done by the farmers themselves.

We present a mathematical model for the transmission of *Trypanosoma brucei rhodesiense*, the acute form of trypanosomiasis in a multi-host and tsetse vector populations. To control tsetse and *T. b. rhodesiense*, a proportion,  $p$ , of cattle, one of the hosts considered in the model is taken to be kept on treatment with insecticides. Two strategies of cattle treatment are considered, that is, “whole-body” treatment of cattle with insecticides and “restricted application” of insecticides on cattle. An analytical expression of the basic reproduction number,  $R_{0n}$ , of the multi-host model is obtained and shown to increase with the number of hosts. For numerical analysis, the model is reduced to three hosts, that is, cattle, humans and wildlife, since cattle and wildlife are known to be the most *T. b. rhodesiense* reservoirs in sub-Saharan Africa. The basic reproduction number,  $R_{03}$ , of the three-host model is analysed to find the proportion of cattle needed to be treated with insecticides in each of the two strategies so that  $R_{03} < 1$ . Sensitivity analysis shows that  $R_{03}$  is more sensitive to the tsetse natural mortality rate parameter. Numerical simulations are carried out to investigate the impact of treating cattle with insecticides on the tsetse population and incidence of *T. b. rhodesiense* in humans and the associated cost-effectiveness ratio per DALY averted is obtained. Results show that the control of tsetse vectors through restricted application of insecticides on cattle is more cost-effective in reducing the tsetse population and incidence of *T. b. rhodesiense* in humans compared to the whole-body treatment of cattle with insecticides. The results show the importance of restricted application of insecticides on cattle, a cheap, safe and farmer based strategy towards the control of tsetse and *T. b. rhodesiense*.