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Abstract

A spatially-explicit simulation model of Rift Valley fever transmission

John Gachohi *, Bernard Bett, Frank Hansen, and Philip Kitala

* **Corresponding author:** International Livestock Research Institute (ILRI), P.O. Box 30709-00100 Nairobi, Kenya; **Tel**: +254-20-4223000; **Fax**: +254-20-4223001; **Email**: j.gachohi@cgiar.org

Background: Rift Valley fever (RVF) is an acute mosquito-borne viral zoonosis that causes periodic epizootics in sub-Saharan Africa. It mainly affects sheep, goats, cattle and camels. The epidemiology of the disease is poorly understood. This is partly because its transmission involves multiple vectors and hosts.

Objective: The aim of this study was to develop a simulation model to evaluate processes involved in the occurrence and transmission of the RVF virus (RVFv).

Methodology: The model involves two hosts (cattle and sheep) and two vectors (*Aedes* spp. and *Culex* spp.). Host dynamics are simulated using an individual-based model while vectors dynamics are simulated using compartmental model. Hosts' characteristics and how they utilize their environment are programmed using static and dynamic rules. These are implemented in C++ programming language. The landscape on which the simulated processes take place is subdivided into spatial lattices of 500 x 500 m using a grid.

Results: Simulations are carried out for the period 1990 – 2010. Initial model outputs captures the main outbreaks observed in 1997/98 and 2006/7. It also shows some inter-epidemic virus activity during the wet seasons. The model predicts that the incidence of the virus is higher in sheep than in cattle. Inter-epidemic virus transmission events do not, expectedly, get amplified to epidemic levels.

Conclusions: The inter-epidemic virus activity is attributed to the emergence of *Aedes* mosquitoes which does not lead to epidemics. This is mainly because the vector population does not rise due to absence of flooding. The results could be used to assess processes that support RVF persistence and effectiveness of RVF interventions.

Key words: Rift Valley Fever, transmission, stochastic simulation model

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