

# PhD defence Robert Sumaye

## Epidemiology of inter-epidemic Rift valley fever transmission in the Kilombero Valley, Tanzania

19 feb 2019 16:00

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Dit is de omschrijving

### Supervisors:

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### Summary:

Rift Valley fever (RVF) epidemics have been associated with periods of unusually high rainfall that lead to sustained flooding over a large area. In Eastern Africa the epidemics have been occurring in cycles of 5-15 years and closely linked to the occurrence of the warm phase of the El Niño/ Southern Oscillation (ENSO) phenomenon resulting into periods of heavy rainfall. RVF cause severe disease in young animals and abortion among pregnant animals, and mild to severe disease in people which might lead to a haemorrhagic syndrome. However low-level Rift Valley fever Phlebovirus (RVFV) transmission occurs during the inter-epidemic periods but most of these remain unrecognised due to inadequate surveillance. The transmission dynamics of RVF both during the epidemics and inter-epidemic periods can be complex and might be uniquely different at fine geographical scales. Recent and longer-standing infection with and exposure to RVFV in people and livestock were investigated during the inter-epidemic period and the relative importance of the interaction between environment and human behaviour on the RVF exposure risk factors was explored in a seasonal flood plain of the Kilombero river valley in Tanzania, which mimics unusual precipitation increase on annual basis. The findings have demonstrated that indeed RVFV transmission does occur during the inter-epidemic period in the study area. This was possible through detection of antibodies against RVFV in animals that were born after the last RVF disease outbreak of 2006/07 in Tanzania and also detection of IgM antibodies in livestock and people. In the livestock population an exposure to RVFV of 11.3% was observed, whereas in the human population the prevalence was 11.7%. In both people and livestock populations, seroprevalence was increasing with age. Recent exposure through detection of immunoglobulins M, a short lived class of antibodies (<60 days) upon exposure to RVFV was also evident in both livestock and human populations. As far as the cattle population was concerned, the presence of four transmission hotspots was demonstrated in the study area with no particular pattern. High animal seropositivity was observed away from the flood plains. Animals that were present during the 2006/07 epidemics had higher seroprevalence compared to younger animals. There was a linear increase in percent seropositivity from 1 year olds to age 5 years, which implies a possible annual challenge by RVFV in the study area. It was further shown that also people become infected with RVFV during the inter-epidemic period and that direct infectious mosquito bites contributed to the current observation. Twelve percent of the participants had evidence of past infection and out of those 3% had recent exposure. Various types of contact with livestock were important risk factors including milking the animals and eating raw meat/ blood: households keeping livestock had more members with evidence of past infection. Again an increase with age of exposure prevalence was evident. Lastly, a mathematical model was used to simulate various scenarios of vector-host-environment interactions to elucidate the transmission dynamics of RVFV and associated key determinants during the inter-epidemic period. The mathematical model showed that several factors contributed to the lowlevel transmission, but invariably included transmission by vector species other than *Aedes mcintoshi*. This species proved nevertheless essential to explain the occurrence of epidemics at regular intervals. This work adds to the increasing body of knowledge on the transmission dynamics of RVFV during the inter-epidemic period. Further studies in particular those targeting febrile patients in the endemic areas where inter-epidemic transmission is common will provide important insight on the RVFV transmission and generate further information useful for disease control strategies in the event of epidemics. The results also highlight the importance for clinicians in the study area to consider RVF in their differential diagnosis in the case of febrile patients.

