

Rift Valley fever research at UP

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Make today matter



UNIVERSITEIT VAN PRETORIA UNIVERSITY OF PRETORIA YUNIBESITHI YA PRETORIA

Faculty of Veterinary Science

Fakulteit Veeartsenykunde Lefapha la Diseanse tša Bongakadiruiwa



Rift Valley fever

- RNA arbovirus *Phenuiviridae*
- First described in 1930s in Rift Valley of W Kenya
- Main vectors are Aedes and Culex spp. mosquitoes
- Main hosts are domestic and wild ruminants
- Emerging zoonosis of global concern







Rift Valley fever

- Large outbreaks at long, irregular intervals
- Abortion storms and mortality in livestock
 - Sheep most severely affected
- Human disease
 - contact with diseased animal tissues
 - mosquito bites?
 - severe complications in 1-2%
- Role of wildlife uncertain
 - clinical disease / abortion
 - subclinical infection















Rift Valley fever cycle







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RVF cycle - epidemic





RVF distribution



https://www.who.int/health-topics/rift-valley-fever

NB: risk for RVFV circulation ≠ risk for RVF outbreaks !



RVF risk factors

- Heavy rainfall and flooding
 - Abnormally high rainfall in low-rainfall areas
 - SA: >double average rainfall in Dec-Feb
 - Normalised difference vegetation index (NDVI)
 - El Niño / Southern Oscillation (ENSO)
- Proximity to wetlands
- Soil type and texture
- Etc....
- Ideal "One Health" subject













- Characterised by large epidemics at long, irregular intervals
 - 1950/51, 1973/74, 2008/11
 - Inter-epidemic periods (IEP) of up to 30 years
- Large epidemics occur across the central plateau
- Smaller outbreaks occur throughout, particularly in the eastern parts of SA
- Until recently, no serological evidence of exposure during IEP





Epidemic areas

Outbreaks only occur when/where:

- 11 rainfall / flooding
- $\uparrow\uparrow$ vector population
- virus present (emergence/introduction) Possible endemic foci

Endemic areas

- Intermittent or continuous viral circulation
- Moderate to high herd immunity
- Small outbreaks /cases likely occur
- Suboptimal surveillance

Intermediate areas – ??

- · Potential for outbreaks
- Lack of data





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A few unanswered questions...

- Differences between central and eastern SA
- Localities and mechanisms of RVFV persistence during the IEP
 - Transovarial transmission in Aedes spp. with long-term survival of eggs
 - Endemic circulation in livestock and/or wildlife
 - Overwintering of adult *Culex* spp.
- Mechanisms of disease emergence after IEP
 - Emergence of infected Aedes eggs
 - Movement of infected hosts
 - Cong-distance vector dispersal
 - Introduction of virus by other means
- Mechanisms of spread during outbreaks
 - Vector dispersal
 - Movement of viraemic hosts
 - ? Multiple introductions or emergences
- Vector ecology
 - Identity and roles of important vectors, vector competence, host preferences, dispersal, ...
- Characterisation of reservoir systems
 - Role of wildlife species, roles of different vector species
- Socioeconomic impact
- Potential effects of climate change



- Free State & Northern Cape:
 - Seroprevalence in livestock, wildlife & farm workers 2015 & 2017
 - Longitudinal serology in sheep to detect interepidemic circulation
 - Mosquito population dynamics and dispersal



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 - Cross-sectional serological study to detect possible endemic circulation





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- Southern KwaZulu-Natal midlands:
 - Cross-sectional serological study to detect possible endemic circulation
- Cross-sectional, longitudinal and vector studies in northern KwaZulu-Natal:
 - Seroprevalence in cattle, goats and wildlife
 - Seroconversion rate in livestock
 - Mosquito population dynamics and host preferences





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Van den Bergh et al (2019) PLOS NTDS 13:e0007296

- Far northern KZN:
 - Knowledge, attitudes and practices of farmers with respect to RVF and other zoonoses
 - Network analysis of livestock movements
 - Risk assessment for potential export of RVFV from area
 - Socio-economic impact of RVF





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 - Network analysis of livestock movements
 - Risk assessment for potential export of RVFV from area
 - Socio-economic impact of RVF
 - Mathematical modelling of RVFV infection dynamics
 - Spatial heterogeneity
 - Relative importance of host, vector and climatic variables
 - Landscape influence on population genetics and dispersal of *Aedes* spp. and *Culex* spp.





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