Rift Valley Fever in Kenya – 100 years

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November 9th, 2018
Outline & acknowledgements

- Background & history of RVF in Kenya
- Recent outbreaks
- RVF control options - new tools
  - Enhanced syndromic surveillance

Map of Africa highlighting Kenya
Introduction

• RVF first recognised 1912 and characterized in 1931 on a sheep farm in Rift Valley region of Kenya
• The virus is an RNA arbovirus Phlebovirus, Bunyaviridae
• Virus transmitted transovarially by Aedes spp mosquitoes (primary vectors)
• Outbreaks associated with el nino weather – persistent heavy rainfall and flooding
• Affects cattle, sheep, goats, camels and humans
RVF virus transmission cycle

ENZOOTIC CYCLE

LIVESTOCK
Aedes MOSQUITOES
EGGS
DAMBO

Aedes MOSQUITOES
EGGS
DAMBO

HUMANS

CULICINE MOSQUITOES, BITING FLIES

CULICINE MOSQUITOES, BITING FLIES

LIVESTOCK
Aedes MOSQUITOES

Aedes MOSQUITOES

EPIZOOTIC CYCLE

HUMANS

LIVESTOCK
Aedes MOSQUITOES

Aedes MOSQUITOES

LIVESTOCK
Aedes MOSQUITOES

Aedes MOSQUITOES

RVF virus transmission cycle
Historical spatial and temporal progression of RVF outbreaks in Kenya, 1912-2007

- 2006/7 outbreak most extensive
  33/69 districts – 15 newly reporting districts
- Eleven national outbreaks

Temporal distribution of RVF outbreaks 1951-2007

Murithi et al., Epi Infect 18, 1-9, 2010
Geographical and temporal distribution of RVF outbreaks, 2010

- 1 billion people at risk
- Huge economic impact on countries animal trade and agricultural sector
- Potential for spread to Middle East, Asia and Europe
RVF control options

- RVF Risk maps
- Refine RVF climatic prediction models
- Case identification and management
- H2H transmission not demonstrated
- Std precautions
- Lab biosafety

- Livestock Vaccinations
- Integrated preparedness and response plans
- Integrated care in health care settings
- Public Health education and risk reduction
- Climatic prediction and early warning tools
- Vector Control

- Reduce susceptible
- Effective vaccines
- Timing
- Reduce human infections
Recent RVF outbreaks in Kenya

December, 1997

- Garissa
  - Est 27,500 RVF infections and 170 deaths
- RVF reported in 22/69 districts

December, 2006

- 700 cases; 158 deaths

June 2018

- 106 cases; 10 deaths

MMWR, April 10, 1998/47(13); 261-264; Wood et al(2002) EID 8(2); Nguku et al; AJTMH 83(2) 5-13; Murithi et al, 2011; Epidemiol Inf 139(3)

- Early detection
- Surveillance and diagnostics
- Early and better coordinated response
- Reduced human mortality
Improving management of RVF outbreaks in Kenya

knowledge gaps and recommendations from 2006-2007 RVF outbreak

- Better characterization of areas at risk
- Enhancing prediction – specificity of forecasting models by incorporating entomological and local factors
- Enhancing surveillance in livestock for early detection of cases
- Use of one health approaches for RVF prevention and control
Research data to inform control options

- Estimating the socio-economic impacts on livelihoods and national level
  - KEs2.1 billion (US$32 million) – 2006-2007 outbreak

- Identifying RVF hotspots
  - Qualitative and semi-quantitative methods
  - Historical occurrence data
  - Outcomes in humans and animals in previous outbreak
  - Geologic, geographic and demographic predictor variables

- Decision support tool kit
  - Identify outbreak phases
  - Matches sequence of events to actions

RVF consultative group, AJTMH, 2010; Hightower et al, AJTMH, 2012; Munyua et al, PLOS NTD 2016; Karl & Wanyoike, AJTMH, 2010
Research data to inform control options

- Mapping vector distributions
  - Surveillance
  - Ecological niche models

- Virus circulation during the IEP
  - Livestock cases in certain areas
  - Need for surveillance

- Modelling control options

- Revision of RVF preparedness and response plan
  - Both human and animal health aspects of response
  - RV Decision support tool kit
  - RVF risk map
  - Socio economic losses

- TTx of the plan using a multistakeholder team

Opportunities for mitigating impact of RVF epizootics

- Surveillance
- Laboratory diagnosis
- Timely Interventions
- Coordinated response
Sentinel herds surveillance for RVF early warning

- Sero-negative livestock are placed in specific locations within high risk areas
  - Monitor sero-conversion indicating virus circulation
  - Serves as an early warning system

- Sero-conversion during IEP

- Timing of sampling, testing to inform decisions
The purpose of this communication is to warn countries in East Africa about the increased risk of occurrence of RVF outbreaks associated with the El Niño event forecasted in late 2015 and 2016.
Early warning for RVF outbreak in Kenya-2018

- Permissive weather MAM period
- Low immunity in livestock
  - Long IEP
  - Low livestock vaccinations
- Inadequate vaccines and too late to vaccinate
- Sub-optimal surveillance
National RVF outbreak control strategies

- National multisectoral coordination committee
  - ZDU – Kenya One health office
  - MOH emergency operation center
- Enhanced RVF syndromic surveillance in Livestock
  - Early identification of RVF cases in animals
- Public health education (national and county)
  - Reduce risk of transmission to humans
  - Case identification and management
Epi-curve of RVF human case, Kenya 2018

Retrospective HF records review

First case

Outbreak confirmed

Ban on livestock slaughter

Deaths n=10
Lab-confirmed cases n=30
Suspected cases n=76

Title: Meat banned in Wajir over Rift Valley fever
Data from Enhanced syndromic surveillance in livestock

- 20 counties – 58/80 sub-counties
- 6,187 reports sent
- 80 calls registered on Toll free number

Reported livestock syndromes by week, May-August 2018
Summary of Livestock specimens test results

Specimens submitted to CVL by species May-August, 2018 (n=3896)

<table>
<thead>
<tr>
<th>Species</th>
<th>No. samples received (%)</th>
<th>No of herds</th>
<th>No of herds with pos(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Caprine</td>
<td>1702(44)</td>
<td>161</td>
<td>49(30)</td>
</tr>
<tr>
<td>Ovine</td>
<td>1154(30)</td>
<td>108</td>
<td>28(26)</td>
</tr>
<tr>
<td>Bovine</td>
<td>601(15)</td>
<td>50</td>
<td>21(42)</td>
</tr>
<tr>
<td>Camel</td>
<td>411(10)</td>
<td>15</td>
<td>4(27)</td>
</tr>
<tr>
<td>Equine</td>
<td>2(1)</td>
<td>1</td>
<td>0(0)</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>3896</td>
<td>335</td>
<td>102(30)</td>
</tr>
</tbody>
</table>

- 31 (66%) counties submitted samples
  - 18/20 high risk
- 23 (74%) counties pos by IgM or PCR
  - 360(9.2%) of specimens pos by IgM or PCR
Counties confirming RVF outbreak in livestock and humans

Lab positive livestock – 23 counties
- 13/18 high risk counties
- 10/13 other counties

Lab positive human – 3 counties
- 25/117 samples from 5 counties
Key observations from the response

- Adopting new tools and technology to tackle old problems
  - Integrated monitoring of livestock syndromes, vector and environmental conditions increased sensitivity of surveillance system
  - Early identification of animal cases
  - Sharing surveillance data to inform case detection in hospitals

- Coordination between national and county officials
  - Joint outbreak response teams

- Coordinated risk reduction measures
  - Public health education
  - Ban on slaughter and market closures
  - Livestock quarantine

- Lab diagnosis to identify etiology for animal syndromes is sub-optimal
- Resources to investigate outbreaks
What have we learnt on translating science to policy to prevent or mitigate epizootics?

- Collaborative multi-disciplinary public health research teams
  - Ownership
- Systematically communicate process and findings with policy markers
  - Develop tools that people are willing to use
Thank you

The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention.