Rift Valley Fever Vulnerability Analysis, Kenya

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Introduction

Rift Valley fever virus (RVFV) is a mosquito-borne pathogen that can infect humans, domestic animals, and wild animals. It was first reported in livestock in Kenya’s Rift Valley in the early 1910’s. Currently, the virus has been identified across Africa and on the Arabian Peninsula. While this disease has been studied for decades, questions related to its ecology and pathogenesis remain unanswered.

In humans, RVFV usually presents as a mild fever and does not progress to life threatening stages. However, 1 - 2% of the population experiences hepatitis, retinitis, encephalitis, and a hemorrhagic syndrome with a high case fatality.

Researchers are very interested in the factors that contribute to the more severe disease outcomes in that small percentage of the human population. Patient co-morbidities may significantly impact disease outcomes. During an outbreak of RVFV in Tanzania, patients with HIV developed RVFV related encephalitis at a higher rate than patients that did not have HIV. It is also possible that other factors, such as poverty and access to healthcare facilities, could influence the outcome of infection with RVFV.

The purpose of this analysis is to identify potentially vulnerable populations in Kenya based on five factors: bed net use, poverty, HIV prevalence, proximity to bodies of water, and density of healthcare facilities.

Methods

- Healthcare facilities and proximity to water: Location data for healthcare facilities and water bodies were imported into ArcMap. Kernel density tool was used on facilities and Euclidean distance was used on water bodies. Zonal statistics was used to determine the average density of facilities and proximity to water per county.
- Assigning risk scores: Data for each of the five factors was reclassified into five risk categories using natural breaks.
- Determining average risk score: Overall risk score per county was determined by calculating the mean risk score for each county. Data was classified into five risk categories.

Conclusions

- This analysis has identified potentially vulnerable populations of people in Kenya. With the exception of Kitui and Kwale, the provinces identified as being the most vulnerable do not have the highest prevalence of RVFV.
- Although Garissa did not have a high average risk score, due to having a low prevalence of HIV, it is still quite vulnerable. It does not have many healthcare facilities, contains many water bodies, and 54.5% of it’s residents live in poverty.
- To improve future vulnerability analyses, more data concerning prevalence of other immunosuppressive diseases and climatic conditions should be integrated.

Risk Score Analysis

<table>
<thead>
<tr>
<th>County</th>
<th>Mean Risk Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Turkana</td>
<td>4.58</td>
</tr>
<tr>
<td>Samburu</td>
<td>4.43</td>
</tr>
<tr>
<td>Kitui</td>
<td>4.35</td>
</tr>
<tr>
<td>Marsabit</td>
<td>4.01</td>
</tr>
<tr>
<td>Kwale</td>
<td>3.99</td>
</tr>
</tbody>
</table>

Table 2 The five most vulnerable counties derived from this analysis.

Data Sources

GADM
DIVA-GIS
FAO EMPRESS-I
WHO Global Health Observatory Data Repository