Malaria and Rift Valley Fever in Baringo County, Kenya

Empowering Communities for better health

Inside:

A product of WHO/TDR/IDRC sponsored research project on Population Health Vulnerabilities to Vector-borne Diseases: Increasing Resilience under Climate Change Conditions in Africa

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Background Information

Malaria causes the greatest public health burden in sub-Saharan Africa. In Kenya, malaria is among the leading causes of illnesses and deaths. It is responsible for almost half of all outpatient attendances and 20% of all admissions to health facilities. Pregnant women and children under 5-years of age are the most vulnerable. Traditionally, malaria has been reported mainly in the lowlands endemic regions of western Kenya (*formerly Western and Nyanza Provinces*) and the coast (*formerly Coast Province*) while the highlands of the Rift Valley have been relatively free except for the sporadic epidemics in some areas such as Kericho, Nandi and now Baringo.

Rift Valley Fever (RVF), on the other hand, was first reported in 1912 in the Kenya's Rift Valley. Since then it has spread to other parts of the country and the African continent. Cases have mainly been reported in the former North-Eastern Province with the first report in Baringo County being in 2007. The disease affects both livestock (commonly goats, sheep, cattle and camels) and human beings where the socio-economic and public health impacts are felt.

Malaria epidemics and RVF outbreaks may be associated with a number of factors among them climatic and environmental given that they are mosquito transmitted and are thus linked to flooding that is experienced during heavy prolonged rains and sudden upsurge of mosquito populations.

Scientists from the Jaramogi Oginga Odinga University of Science and Technology and the University of Nairobi implemented a 3-year study whose main objective was to assess the vulnerability of populations living in the dry lands of Baringo to both Malaria and RVF and develop strategies and systems to improve their resilience to these diseases.

Overall Objective

To assess vulnerability of dry-land human populations to malaria and Rift Valley Fever

Key Output

To develop strategies and systems to improve the populations' resilience to the two climate sensitive vector-borne diseases.

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Study Site and Map

This study was conducted in Baringo County in the Rift Valley of Kenya. Focus was on 3 sub-counties of Baringo Central, Baringo North and Marigat, which were further classified into 4 ecological zones based on soil type, land form, altitude and climatic characteristics.

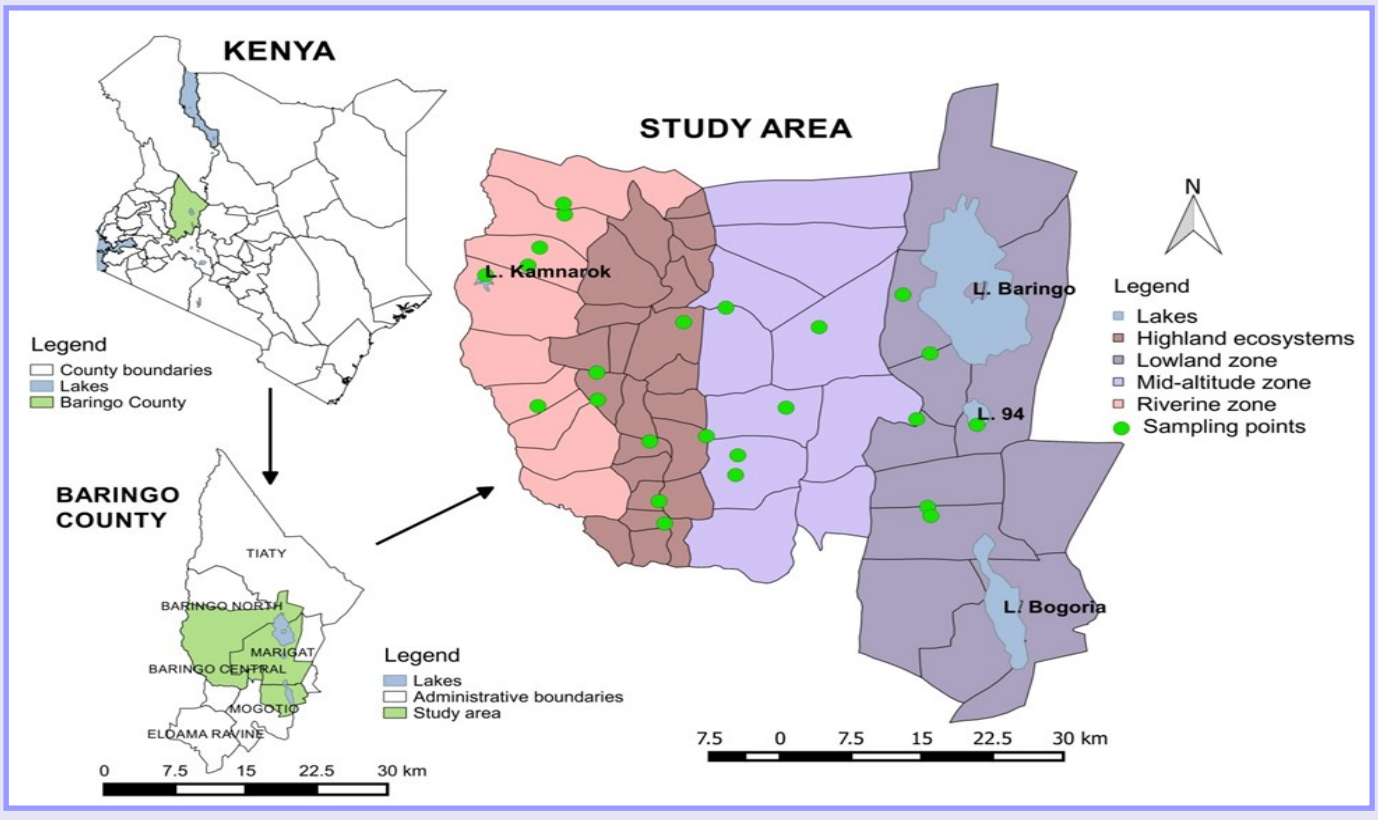
The 4 zones were:

1) The Lowlands consisting of Marigat town, Salabani, Ngambo, Perkerra, Kampi ya Samaki, Loruk, Endao, Kiserian and Nteppes, Kapkuikui, Loboi , Loitip, Sirata, Lorrok, Sandai and Longewan;

2) The Midlands consisting of Sabor, Kimalel/Koriema, Kipcherere, Kimondis, Bartum, Kimao;

3) The Highlands consisting of Kabarnet town, Talai, Kaptum, Kibonjos, Kaptich, Kiptagich, Tenges, Kaptimbor, Borowonin, Kabartonjo; Kapchepterit and

4) The Riverine -bordering the Kerio River and consisting of Barwessa, Salawa, Keturwo, Kapluk, Konoo, Kapkelelwa, Litein, Koibarak, Jamindoi, Sagasak, Kurumbopsor, Kaptara, Kamnarok (see map).



Data collection was achieved through 7components namely; Anthropology, Entomology, Spatial modeling, Eco-hydrology, Parasitology, Virology and Health economics.

Project Components

Anthropology

The component assessed the socio-cultural factors that contribute to vulnerability of the population to malaria and RVF. Knowledge, attitude and practices was assessed through focus group discussions (FGDs), key informant interviews and observations.

Entomology

Assessed malaria and RVF vector ecology and behaviour in the 4 ecological zones. Both qualitative (presence, distribution and habitat preference of different mosquito species)

and quantitative (variability in mosquito density, species abundance and their infection status) data sets were collected over a period of 18 months from selected sampling points across the study area.

Project Components

Parasitology

Assessed the prevalence of malaria among school going children during the wet and dry seasons. A total of 1668 pupils from 15 primary schools between 5 and 15 years of age were sampled and tested for malaria parasites.

Virology

Assessed the inter-epidemic sero-epidemiology of Rift Valley Fever in livestock and humans in Baringo County, Kenya. This was done through collection of human and livestock (cows, goats and sheep) blood samples for testing of RVF antibodies.

Project Components

Eco-Hydrology

Assessed the relationship between ecology, environment and malaria vector abundance and risks. Mosquito larvae were collected longitudinally over a one year period alongside climate and hydrological data sets. Retrospective clinical data on malaria from health facilities and focus group discussion (FGDs) and Key Informant Interviews (KII) were also conducted and triangulated to establish community based malaria control strategies.

Health Economics

Sought to establish the economic burden associated with treating malaria in the riverine zone of Baringo County. This was done through a cross-sectional household survey of select respondents residing within the riverine zone (Kerio valley) of the study area.

Project Components

Spatial Modeling

This entailed modelling the effect of climatic factors on the occurrence of 2006/2007 RVF outbreaks in humans and livestock using Lake Baringo water levels and remotely sensed climatic data on rainfall, temperature and enhanced vegetation index. Longitudinal sampling of larvae and adult mosquitoes was also undertaken in the study zone to determine species occurrence.

Summary of Findings on Malaria

Knowledge, Attitude and practices

- Local communities know malaria as a serious disease transmitted by mosquitoes;
- Most people delay going for medical care in nearby health facilities when sick with malaria;
- Men stay out late in the night (guarding their livestock) and therefore have prolonged exposures to mosquito bites;
- Treatment of malaria involved both traditional and conventional methods .

Prevalence and incidence

1. Study reveals that malaria is prevalent in Baringo County, highest in the Riverine zone (23%) followed by the Lowlands (0.9%)
2. Transmission is not only seasonal but perennial, raising concerns on the existence of malaria transmission hot spots in this area.
3. The Riverine zone recorded the highest risk while lowlands, midlands and highland recorded minimal risk or no risk of infection.
4. Children living close to Kerio River and Lake Kamnarok had the highest incidence.

Malaria Vector Distribution

- The greatest density of malaria carrying mosquitoes was in the Lowlands where *Anopheles gambiae* was the main malaria vector.
- Mosquito numbers in houses with open eaves were higher compared to those with closed eaves.
- Grass-thatched ,mud-walled houses were easily access by mosquitoes compared to iron-sheet roofed and stone walled houses.
- Unique grass-thatched mud-walled houses raised on stilts (*Bororiet*), were found to have very few mosquitoes.
- The distribution of mosquitoes varied among the surveyed zones with the greatest diversity in the Lowlands .

Prevention and Control

1. Communities used both traditional and conventional strategies to keep away malaria carrying mosquitoes;
2. Traditional strategies included burning of plant materials from trees such as *Croton dischogamus* and cow dung;
3. Key conventional strategies included the use of bed nets, mainly given to pregnant women and children under 1 year
4. Majority inconsistently used bed nets and this promoted possible continuous exposure to malaria infection;
5. Treatment of malaria involved both traditional and conventional methods
6. Traditional methods involved herbal medicines comprising infusions and decoctions prepared from plant materials, mainly leaves, barks and roots .

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Summary of Findings on Rift Valley Fever

Knowledge , Attitude and practices

1. Community knowledge on causes, transmission and clinical signs and symptoms of RVF in both humans and livestock was generally low.
2. Community practices which were likely to increase exposure to RVF infections included:

⇒ consuming animal products from sick and dead animals;

⇒ poor disposal of dead animals; and

⇒ foetal materials from aborted animals

3. Male community members were more at risk of infection than females due to their roles in livestock production.

Prevalence and incidence

1. Prevalence of RVF antibodies in animals was 5.6% an indication of previous exposure to the RVF virus.
2. A significantly high proportion of sero-positivity was recorded in animals sampled from the Low-land zone .
3. Cattle had the highest sero-prevalence of 6.1%, goats 5.9% and sheep 4.6%.
4. Older animals of 5 years and above were more affected than those below this age.

RVF Vector Distribution

- RVF mosquito species prediction maps and models showed that the lowlands between Lake Baringo and Lake 94 were the most suitable habitats for the RVF.

⇒ Four secondary RVF mosquito species- *Mansonia* uniformis, *M. africana*, *Culex univittatus* and *Cx. pipiens* s.l. were identified

- Mosquito species varied in their distribution with the highest proportion, 82.5%, found in the Lowland zone where RVF had earlier been reported.
- With changes in climate, the suitability of other areas such as the riverine zones where RVF has not occurred was increasing, hence the possibility of vectors spreading to other zones.

Prevention and Control

1. Communities were advised to ensure that animals slaughtered for domestic consumption are inspected by qualified veterinary personnel.
2. Protective wear was recommended while handling livestock suspected to have died of disease.
3. Burry or burn carcasses of dead animals.
4. Community advised not to skin dead animals before burying.
5. Government imposition of bans or quarantine on livestock movement.
6. Strategic livestock vaccination before onset of heavy rains.

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Events

The Vice-Chancellor of Jaramogi Oginga Odinga University of Science and Technology, Prof. Stephen Agong' (*Seated 4th from right*) joins the project team during a progress monitoring workshop at KPA's Training Centre in Morendat, Naivasha.

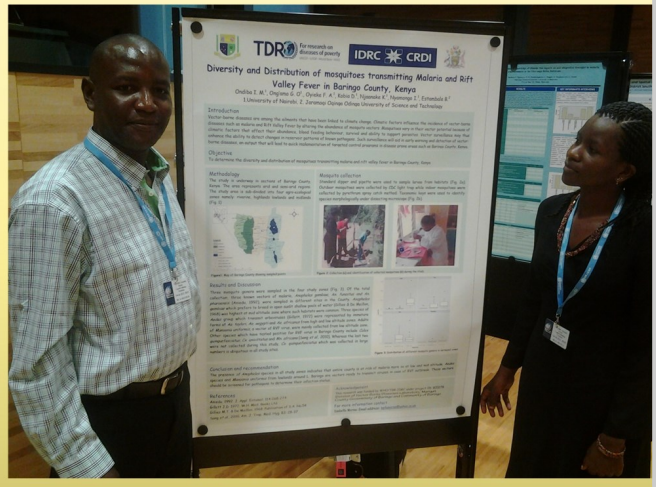
During the three (3) year period, the project team conducted local public forums, progress monitoring seminars and trainings to share knowledge for successful implementation.

Enumerator Training for KAP survey at the Kabarnet Field Office in Baringo County

A section of the research team during a Methodology workshop held at the Kenya School of Government in Kabarnet

Events

Scientific Forum & Capacity Building workshop (Geneva July 2015)



PhD students attending seminars in Geneva and South Africa respectively.

In order to build capacity for stakeholders to promote the utilization of developed strategies, the project brought on board 4PhD and 5 MSc students who have been trained .

Research team is joined by local Public Health and Veterinary Officers during a data sharing forum in Eldoret , Kenya.

Community Outreach

1

2

The project held 14 (fourteen) public community feedback meetings in Baringo County which were attended by over 17,500 participants from different sub-counties. Key messages on the two vector-borne diseases from the project findings were shared with the community.

1. Deputy President, H.E. William Ruto presents a trophy to the project team for the best stand in Research and Development at the Kabarnet ASK Show in 2016.
2. County Administrators during a leaders Sub-County level leaders' dissemination forum at Koibatek (Eldama Ravine) in Baringo.
3. Project team members with the local community at Nakoko during a dissemination forum.
4. Project team during a sensitization meeting at Mogotio.
5. A Public Health officer addresses the community during an outreach session at Salawa Division.

3

4

5

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Recommendations for Prevention and Control of RVF

1. Continual education of the community by the veterinary department to improve knowledge on RVF causes, symptoms, risk factors and prevention.
2. Establishment of Sentinel herds by the county veterinary department in the hotspot areas for surveillance and monitoring of vector and virus activity for timely and effective responses to RVF outbreaks in line with RVF contingency and control programs.
3. Maintenance of adequate stockpiles of RVF vaccines by the county Veterinary department to facilitate strategic prevention and control programs.
4. Incorporation of area-specific vector predictive maps of Baringo in the existing national RVF contingency plan by the veterinary department as part of an im proved local preparedness and early response to RVF outbreaks.

Recommendations for Prevention and Control of Malaria

1. Improvement of community knowledge on malaria through continual education about malaria causes, treatment regimens and prevention.
2. Strengthening of surveillance and management of malaria cases by provision of adequate malaria medication to all vulnerable populations in line with national malaria treatment and control guidelines.
3. Supporting the community in the acquisition of long lasting insecticide treated nets（LLINs） and educate them on their use.
4. Implementing cost effective integrated vector management（IVM） strategies, including the sealing of house eaves with screens in malaria high-risk areas.
5. Ensuring consistent availability of RDT kits for cost effective diagnosis in order to support prompt management of malaria cases.
6. Liaising with institutions that provide climatic and environmental data and models as well as conventional and indigenous climate forecasts to provide locally appropriate information for Early Warning Systems（EWS） for malaria.

Project Team from the Collaborating Institutions

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Ms. Jepkosgei
Research Assistant

Mr. Mbalanya
Research Assistant

Mr. Obila
Project Driver

Collaborating WHO/TDR/IDRC Projects

WHO/TDR/IDRC supported five (5) research multi-disciplinary teams to conduct research on climate change variability on the occurrence of vector-borne diseases: These teams are spread across Africa and include:

1. **Team A**: Research on Malaria & Bilharzia, conducted across Botswana, South Africa and Zimbabwe and based in Kwa Zulu Natal, University in South Africa
2. **Team B:** Research on Malaria & RVF, based in Jaramogi Oginga Odinga University of Science and Technology and University of Nairobi in Kenya.
3. **Team C:** Research on African Tripanosomiasis, based at Nelson Mandela Institute of Science and Technology and Sokoine University of Agriculture &Technology in Morogoro, Tanzania
4. **Team D,** Research on African Tripanosomiasis, based in South Africa
5. **Team E**, Research on Malaria conducted across Ivory Coast and Mauritania.

Publications

1. E.N. Mutua, S.A. Bukachi, B.K. Bett, B.A. Estambale and I.K. Nyamongo (2016). *Lay knowledge and Management of Malaria in Baringo County, Kenya.* ***Malaria Journal. 15:486 DOI 10.1186/s12936-016-1542-9***
2. A.O. Ochieng, , M.Nanyingi, E. Kipruto, I.M. Ondiba, , F. A. Amimo, C. Oludhe, D. Olago, I.K. Nyamongo and B.B.A. Estambale (2016). *Ecological niche modelling of Rift Valley fever virus vectors in Baringo, Kenya. Infection Ecology and Epidemiology.* ***Infection Ecology and Epidemiology 2016, 6: 32322 - http://dx.doi.org/10.3402/iee.v6.32322***
3. C.J. Omondi, L.M. Kamau, H.K. Njaanake, D.Anyona, D.Onguru, B. Estambale (2017). *Evaluation of Three Rapid Diagnostic Test Kits in the Diagnosis of Plasmodium Species Infections among Primary School Children in Baringo County, Kenya (2017)* ***Open Journal of Clinical Diagnostics , 7, 31-44. https://doi.org/10.4236/ojcd.2017.71004***
4. E.K. Kipruto, A.O. Ochieng, D.N. Anyona, M. Mbalanya, E.N. Mutua, D. Onguru [2], I.K. Nyamongo, B.B. Estambale *(2017). Effect of Climatic Variability on Malaria Trends in Baringo County, Kenya(2017).* ***Malaria Journal in Press.***
5. E.N. Mutua, S. A. Bukachi, B. K. Bett, B. A. Estambale, I.K. Nyamongo (2017). *We Do Not Bury Dead Livestock Like Human Beings": Risk to Rift Valley Fever in Baringo County, Kenya (2017).* ***PLOS NTD in Press***

Baringo County Commissioner, Mr. Peter Okwanyo (Seated 5th from right) and other stakeholders join the research team in its final dissemination forum at the Noble Conference facility in Eldoret town, Kenya.

WHO Team site visit

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- Ministry of Health, Baringo County
- Ministry of Agriculture, Livestock & Fisheries, Baringo County
- Ministry of Education
- Ministry of Interior and Coordination of National Government
- Directorate of Culture and the Arts, Baringo County