Review of Malaria Epidemiology in Rwanda

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Abstract: Malaria in Rwanda is one of the major health issues to be tackled diligently by both researchers and government officials. In Rwanda malaria is seasonal disease and environmentally related. Where eastern province is more epidemic-prone than the rest of the provinces of Rwanda.

Keywords: Malaria, environmental changes

Introduction

Rwanda is a small (26,338 km²), land-locked country in the Great Lakes region of Eastern Africa, bordered by Uganda, Burundi, the Democratic Republic of the Congo, and Tanzania. It has a population of approximately 12 million people (projection from 2012 census results), making it the most densely populated country in continental Africa. Administratively, the country is made up of 30 districts, which are divided into sectors, cells (cellules), and 14,953 umudugudus (villages of 50–100 households). The entire population is at risk for malaria, including an estimated 1.8 million children under five years of age (14.6% of the population) and 443,000 pregnant women/year (30.2% standardized birth rate; projections based on 2012 census results).(1)

Malaria parasite was discovered in 1880 by Alphonse Laveran (2). Africa had no malaria before and according to Nandi elders, malaria was introduced into Africa by African soldiers who participated in First World War in 1918 and 1919 and after coming back, 25% of the indigenous population got the disease. (3). In Rwanda, malaria was not a health problem since its introduction in 1918 (3). The risk of getting Malaria disease in Rwanda can be partially explained by social conditions of Rwandan population (4) and environmental changes (climatic change).

In Rwanda, malaria presence is associated with climatic changes, as the climate was changing since first world war led to changing of malaria prevalence in Rwanda (5). Study in Rwanda found that recent increases in temperature and rainfall were associated with a steep rise in malaria cases (3). DDT was used to treat mosquito nets in Rwanda but now it has gone out of its use, it cannot be used because it has health effects.

DDT elimination in Rwanda it was as a result of Stockholm Convention negotiations which helped lives to be saved and diseases prevented as a consequence using an alternative measure (6). Even though all those were done in Rwanda but malaria is still health threat that bit used to be during its introduction to Africa.

Rwanda experienced an upsurge in malaria cases with 1.7 times more cases than in 2013. The NMCP, PMI, and other malaria stakeholders are currently investigating the drivers of this increase to respond appropriately. Data from early 2015 reveal that the NMCP responses are having an effect as malaria cases have decreased compared to the same time period in 2014, but analysis is ongoing.(7)

Malaria situation in Rwanda

According to NMCP’s health management information system (HMIS) data from June 2015, the NMCP has classified 19 (63%) of the country’s 30 districts as epidemic-prone and the remaining 11 as endemic including Bugesera, Gatsibo, Kabutare, Kamonyi, Kayonza, Kirehe, Muhanga, Nyanza, Ruhango, and Rwamagana. Of these 11 high burden districts Ruhango, Kirehe, Kayonza, Gatsabo, and Ngoro are supported by PMI and Global Fund supports the remainder and most are of eastern province. The NMCP has also targeted eight districts for pre-elimination activities: Burera, Gakenke, Gisagara, Musanze, Ngororo, Nyabihu, Nyagatare, and Rubavu. According to the HMIS data, the 11 endemic districts accounted for 76% of all malaria cases reported. Malaria transmission occurs year-round with two peaks from May to June and from November to December in the endemic zones following distinct rainy seasons.(7) In addition to climate and altitude, other factors that influence malaria in the country include high human concentration near vector habitat (e.g., boarding schools in proximity to marshlands); population movement (especially from areas of low to high transmission); irrigation schemes (especially in the eastern and southern parts of the country); and cross-border movement of people (especially in the eastern and southeastern parts of the country).(7)

In recent years Rwanda has seen an increase in reported malaria cases, from an estimated 225,176 cases in 2011 to 1,598,055 in 2014 and more in 2015. (1) as malaria parasites are difficult to handle and they ability to develop is complex (8)
Interventions to fight against Malaria in Rwanda have resulted in small decline of malaria incidence. But this achievement is slow as for local malaria transmissions remain and the risk of getting malaria infection is explained by social and environmental factors (9). Due to temperature and rain fall change in Rwanda malaria reoccurs even though, the government has put control mechanisms such use of Long-lasting insecticidal nets (LLIN), indoor residual spraying (IRS) and malaria case treatment with artemisinin-based combination therapy (ACT) and have been proven to reduce malaria incident, but may not lead to malaria eradication.(10)

As malaria is both sensitive to environmental and socio-economic factors, and malaria is the interplay of climate variability and interventions in Rwanda highlands. Malaria and interventions related data from Rwandan Ministry of Health show that malaria depends on both environment and socio-economic factors.(11)

### Climatic Factors and Malaria
Rainfall plays an important role in malaria epidemiology because water not only provides the medium for the aquatic stages of the mosquito’s life cycle but also increases the relative humidity (12). For example, in Gambia, malaria transmission is restricted largely to the rainy season.(13) However, rain may prove beneficial to mosquito breeding if moderate, but it may destroy breeding sites and flush out the mosquito larvae when it is excessive. And in the intermediate rainfall zone of Sri Lanka both the correlation and regression analyses suggest that temperatures and rainfall act on malaria with a lag of one month. Because most of the malaria cases in Shuchen County were associated with Plasmodium vivax, such delays are consistent with the estimated minimum temperature generation time of a case of Plasmodium vivax (12).

### Is the Warming associated with increased incidence of Malaria?
Global environmental change is expected to increase the incidence of vector-borne diseases, especially malaria. (14) In Rwanda due to malaria increase in its neighboring countries such as DRC Congo, Burundi because of monthly rainfall and minimum temperatures which were the top environmental predictors for malaria risk (1), Uganda, Kenya and Tanzania, malaria increased due to El Niño (15). Malaria has increased dramatically and this is due climate change and temperature raise. (16) In Rwanda malaria is influenced by three risk factors which are Environmental factors, Biological and Human related factors as it is summarized in the figure below.

![Source](17)

**Figure 1.** Conceptual model of important risk factors affecting malaria prevalence in the African Highlands. Factors are regrouped in 3 main classes (environmental factors: green label, biological factors: grey label and human related factors: blue label). Dependent variables included in the CART analysis are displayed in red and predictor variables are highlighted in white (17).

### References
6. Tren R, Roberts D. DDT and malaria...


