Malaria in School Children In Rwanda: A Review Article

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Abstract
Malaria infection is caused by plasmodium species of which plasmodium falciparum is widespread in Africa. Globally, around 500 million school children are at risk of malaria and 200 million are counted in sub-Saharan countries. Efforts were made to reduce and eradicate malaria including distribution of long-lasting insecticide-treated nets (LLINs) and use of artemisinin-based combination therapy (ACT) drugs, and indoor residual spraying have led to declines in malaria. However sub- Saharan Africa still suffers greatly from the disease. Malaria is one of the leading causes of mortality in Africa with about 90% of the 528,000 malaria deaths estimated globally, occurring in the African region. Even if much effort has been done towards prevention and control of malaria in sub-Saharan countries and Rwanda in particular, little is known about.Prevalence of malaria in school children in Rwanda. The present study envisages to review the current body of knowledge on prevalence and risk factors of malaria among school children in Rwanda.

Keywords: *Malaria parasites, Children, School, Rwanda.*

I. Introduction

Globally, around 500 million school children are at risk of malaria and 200 million are counted in sub-Saharan countries. [1]Thus, mostly, malaria scrutiny and interventions in prevalent region very often focus on young children and pregnant women population are at highest risk of malaria morbidity and mortality.[2] Thus, school children with malaria infections, mostly asymptomatic, may show an important part in constant transmission and then after forgotten in surveillance and control strategies.[3] Consequently, approximately 6-9% of all plasmodium death was retrieved in students aged 5-14 years, globally representing 70,000-110,000 malaria death per year. [1]

Malaria infection is caused by plasmodium species of which *Plasmodium falciparum* is widespread in Africa. Distribution of long-lasting insecticide-treated nets (LLINs) and use of artemisinin-based combination therapy (ACT), and indoor residual spraying have led to declines in malaria. However sub- Saharan Africa still suffers greatly from the disease. Malaria is one of the leading causes of mortality in Africa with about 90% of the 528,000 malaria deaths estimated globally, occurring in the African region. [4–6]

Between 2000 and 2015, malaria incidence rates fell 37% globally, and malaria mortality rates by 60%, with even greater declines in Africa, the highest-burden region. [7] The burden of malaria in countries in sub-Saharan Africa has declined with scaling up of prevention, diagnosis, and treatment. [8] Malaria caused 8.27% all deaths among children aged 5-14 years in Rwanda in 2017. [9]

Malaria prevalence among school-aged children is under-researched and not well understood. The major sources for malaria data are health management information systems (HMIS) and large household surveys such as Rwanda Demographic and Health Surveys (RDHS). However, the HMIS captures only malaria cases for those seeking care at health facilities, while RDHS focused malaria for under five Children. [10] In 2014, the prevalence of Plasmodium infection was estimated at 1.4% in Ngoma sector and at 47% in the rural Kigoma sector in Huye district. Malaria has been attributed to risk factors including altitude, climate, occupation and socio-economic status. [11]

The quality of housing, has been reported to influence the ease for mosquitoes to enter and hide in a home. The risk of malaria in members of households with walls made of mud/grass/wood is almost twofold the risk of malaria in among those living in households with walls made of brick or stone. Ownership and proper use of insecticide-treated mosquito net have malaria proctice effect. However, the use of bednets is affected local house structures where most houses have limited structures on which to hang bednets and most hoseholds members share sleeping spaces on the floor. [12]

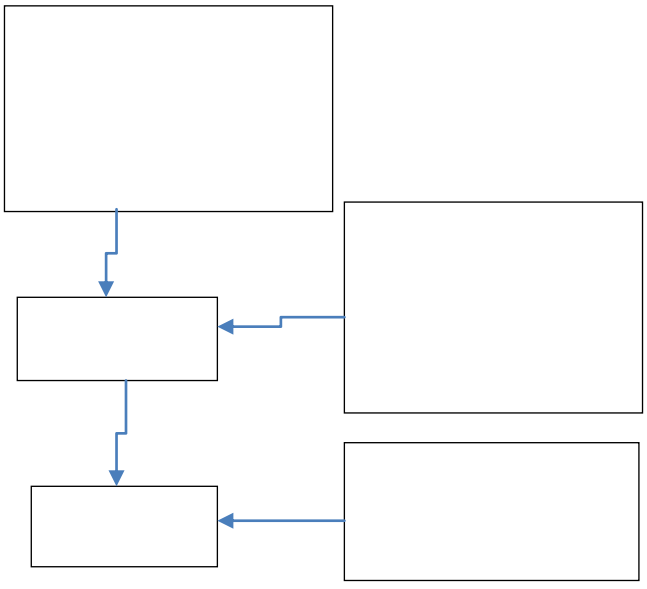
Malaria risk factors have been studied on a small scale and the main focus for children was put on the group of children under 5 years of age as they are one of most vulnerable groups affected by malaria.[13–14]

There is no information on effect of malaria on cognitive abilities, and the effect of Anthiheliminethics drugs in children aged five to twelve years in Rwanda.
Even if much effort has been done towards prevention and control of malaria in sub-Saharan countries and Rwanda in particular, little is known about Prevalence of malaria in school children in Rwanda. The present study envisages to review the current body of knowledge on prevalence and risk factors of malaria among school children in Rwanda.

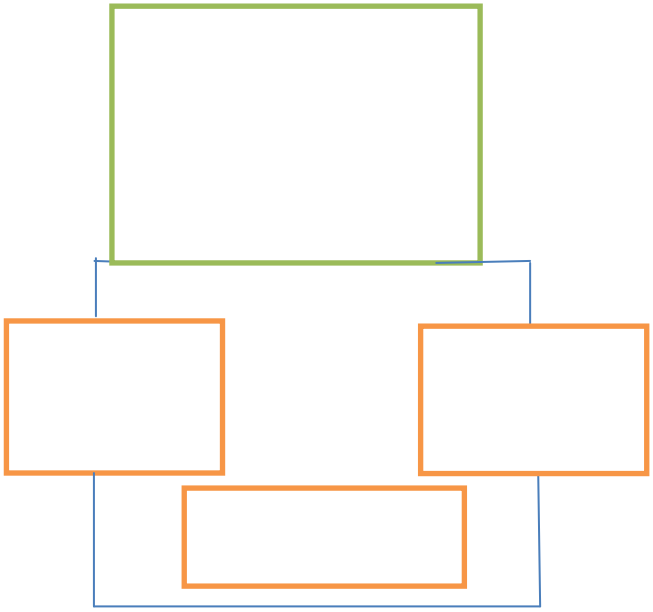
Methods

A review of studies investigating the prevalence of Malaria for schoolchildren in Rwanda was done. 865 studies were extracted from Pubmed, ScienceDirect, Web of Science and African Journals OnLine search engines. The searching words were "prevalence “and "malaria" and "school" and "children" and "Rwanda". The first screening included 21 whereas 844 studies were excluded because it was not related with the topic or not located in Rwanda. From 21 studies included, 4 were re-reviewed and 17 studies excluded because the population study were under five children
The review of the literature from the following research databases was conducted to map the prevalence of malaria in school children, to report on risk factors of malaria development and the effects of malaria on cognitive abilities of children in Rwanda.
The search engine used were: the gray literature in Google scholar, Web of knowledge, PubMed, Science direct, African journals online.
The period covered was not limiting the starting date, rather the ending date was set to be August 2019.

Results and discussion



The first screening included 21 whereas 844 studies were excluded because it was not related with the topic or not located in Rwanda. From 21 studies included, 4 were re-reviewed and 17 studies excluded because the population study were under five children.
The following is the scrutiny of papers found to report on risk factors, effect of malaria on cognitive abilities as well as antihelminethics drugs effects on Malaria in School Children between in Rwanda.



The studies that met the inclusion criteria that include prevalence of malaria, risk factors in Rwandan children are as follow:

Summary of paper on malaria in Rwanda

A study entitled applying citizen science for malaria prevention in Rwanda was conducted to develop an Integrated model based on Health belief model, Theory of planned behavior, and Unified theory of acceptance and use of technology) of determinants of malaria prevention behaviour. The researcher concluded that The model will guide future research on behavioural and contextual factors and may enhance the effective and consistent use of malaria preventive and control interventions .[15]
Other researchers used a literature review to conceptualize the social vulnerability to malaria and to select the appropriate vulnerability indicators. They followed steps including those of selection of indicators and datasets, imputation of missing values, descriptive statistics, normalization and weighting of indicators, local sensitivity analysis and indicators aggregation. Correlation analysis was used to assess the association between the indicators and malaria incidence.The high values of social vulnerability to malaria were found in Gicumbi, Rusizi, Nyaruguru and Gisagara, and low values in Muhanga, Nyarugenge, Kicukiro and Nyanza. The most influential susceptibility indicators to increase malaria were population change (r = 0.729), average number of persons per bedroom (r = 0.531), number

of households affected by droughts and famines (r = 0.591), and area used for irrigation (r = 0.611). Based on findings, social vulnerability to malaria indicates which indicators need to be addressed and in which districts. [16]

Some researchers conducted a study on Prevalence and risk factors of malaria among children was conducted on a small scale (in southern highland Rwanda). They examined 749 children below five years of age including 545 randomly selected from 24 villages, 103 attending the health centre in charge, and 101 at the referral district hospital. They collected data on clinical, parasitological, haematological, and socio-economic variables. They finally concluded that Plasmodium falciparum infection in the highlands surrounding Butare, Rwanda, was seen in one out of six children under five years of age. They added that the low socio-economic status and insufficient effectiveness of self-reported bed net use refer to areas of improvable intervention .[16]

A study was conducted on community mobilization for malaria elimination in Ruhuha sector, Rwanda. an open space methodology was applied with horizontal approaches to explore local priorities, stimulate community contribution to project planning, and to promote local capacity to manage programmes. Two open space meetings were conducted with 62 and 82 participants in years 1 and 2 respectively. The study findings suggested that some misconceptions of the cause of malaria and misuse of preventive strategies. Poverty was deemed to be a contributing factor to malaria transmission, with suggestions that improvement of living conditions for poor families might help malaria reduction. [17]

A Research study on factors impeding the acceptability and use of malaria preventive measures was conducted with Nine focus group discussions (FGD) of 81 lay community members and local leaders in Ruhuha, Southern Eastern Rwanda in December 2013. The main purpose was to determine community perceptions on malaria disease, acceptability of LLIN and IRS, health care-seeking behaviours and other malaria elimination strategies deployed at household and environmental levels. In conclusion, the concept of malaria elimination was acknowledged. Increase of bedbugs and discomfortable warmness particularly during the dry season were reported common factors for hindrances of the use of LLIN .[18]

In 2012, a team researchers conducted a study on trends in malaria cases, hospital admissions and deaths following scale-up of anti-malarial interventions, 2000–2010, Rwanda. They conducted a review of District records of ITN and ACT distribution. Malaria and non-malaria indictors in 30 district hospitals were ascertained from surveillance records. Trends in cases, admissions and deaths for 2000 to 2010 were assessed by segmented log-linear regression, adjusting the effect size for time trends during the pre-intervention period, 2000–2005. As conclusion, over 50% decline in confirmed malaria cases, admissions and deaths at district hospitals in Rwanda since 2005 followed a marked increase in ITN coverage and use of ACT. The decline occurred among both children under-five and in those five years and above, while hospital utilization increased and suitable conditions for malaria transmission persisted. Declines in malaria indicators in children under 5 years were more striking than in the older age groups. [19]

A study conducted on malaria, aneamia and under-nutrition to measure the prevalence of malaria parasitaemia, anaemia and under-nutrition among preschool age children in a rural Rwandan setting and evaluate interactions between and risk determinants for these three conditions revealed that the prevalences of malaria, parasitaemia and anaemia were 5.9 and 7.0 %, respectively, while the prevalence of stunting was 41.3%. Under-nutrition was not associated with malaria risk .[20]

A malariometric survey conducted in Rwanda to measure rates of malaria parasitaemia and evaluate risk factors associated among asymptomatic household members in a rural community in Rwanda reported that malaria parasetemia was 5% in the studied population, with at least 13% households having at least one parasitemic member. High malaria parasite carriage risk was found to be associated with being male, child or adolescent

A malaria parasite carriage risk-protective effect was associated with living in households of, higher socio-economic status, where the head of household was educated and where the house floor or walls were made of cement/bricks rather than mud/earth/wood materials. Parasitaemia cases were found to significantly cluster in the Gikundamvura area that neighbors marshlands.[21]

A cross sectional study conducted on malaria prevalence, spatial clustering and risk factors in a low endemic area of Eastern Rwanda revealed that malaria prevalence among health centre screened was 22.8%. At the household level, 90 households (out of 520) had at least one malaria-infected member and the overall malaria prevalence for the 2634 household members screened was 5.1%. Among health centre attendees, the age group 5–15 years was significantly associated with an increased malaria risk and a reported ownership of 4 bednets was significantly associated with a reduced malaria risk. [22]

A study conducted on peadiatrics hospitalization for malaria following implementation of community based malaria control programme in rural Rwanda revealed that out of 551 admission reviewed, 268(48.6%) and 437(79.3%) were comfirmed malaria cases after laboratory exams. Among children admitted with laboratory-confirmed malaria, the risk of high parasitaemia was higher during the pre-intervention period relative to the post- intervention period (age-adjusted PR: 1.62; 95% CI: 1.11 – 2.38;

chi-squared p-value = 0.004), and the risk of severe anaemia was more than twofold greater during the pre-intervention period (age- adjusted PR: 2.47; 95% CI: 0.84 – 7.24; chi-squared p-value = 0.08) .[23]

Another study conducted to map malaria infection among schoolchildren in highland Rwanda by estimating infection prevalence among children attending school, at identifying associated factors and at assessing the clinical consequences of these infections pointed out that the majority of the children were asymptomatic(fever: 2.7%), plasmodium infection was detected in 22.4% (Plasmodium falciparum, 18.8%); 41% of these were submicroscopic. Independent predictors of infection included low altitude, higher age, preceding antimalarial treatment, and absence of electricity or a bicycle in the household. Plasmodium infection was associated with anaemia (mean haemoglobin difference of −1.2 g/dL; 95% CI, −0.8 to −1.5 g/dL), fever, underweight, clinically assessed malnutrition and histories of fever, tiredness, weak- ness, poor appetite, abdominal pain, and vomiting. With the exception of underweight, these conditions were also increased at submicroscopic infection. [24]

Basing on the reported high prevalence, interventions targeting malaria control and elimination were done including a citizen science approach for malaria mosquito surveillance and control in Rwanda. [25] This study revealed that mosquito monitoring programmes are not carried out to monitor the impact of all vector control interventions or to determine the distribution of mosquito species in all areas, especially in the remote regions of the country. In this study a citizen science approach as a capacity resource for malaria vector monitoring for the Rwandan National Malaria Control Programme was introduced and tackles the control of invasive mosquito species, data sharing on mosquito sightings by citizens through an open web-based platform. [11]

Conclusion

This review article suggests that studies on prevalence and risk factors on malaria in Rwanda have been conducted on a small scale in malaria-endemic regions. Children and pregnant women have been groups of interest for research because of their increased susceptibility and exposure to malaria. Based on the literature from reviewed studies, malaria incidence has reduced significantly over the last two decades following both clinical and community-based malaria treatment and control.

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