Prevalence of Malaria among Patients Attended Muhororo Hospital

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Abstract

Background: The rate of malaria continues to increase because it is not easy to eradicate it. This study entitled "Prevalence of malaria among patients attended Muhororo hospital. Rwanda". The specific objectives guiding this study were; to identify plasmodium species among patients attending Muhororo hospital, to specify age group and sex screened with high level of malaria, to evaluate the change in the level of malaria from 2013 to 2017 and to assess the risk factors of malaria in the region of Muhororo hospital.

Methods: The sample were collected by cleaning fourth finger by cotton imbedded in 70% ethyl alcohol, then drying finger by using dry cotton or gauze. Finger was picked with one motion, first drop of blood was removed by using dry cotton and the second one taken on new slide then spread in one direction approximately one mm. Dried blood colored by using GIEMSA solution diluted 1/10 within 25 minutes then after read under oil immersion of microscopy. The obtained data were processed and analyzed with Microsoft Excel 2010, SPSS v16.0 and Microsoft word for coding and sorting, tabulation as well as final report of dissertation.

Results: The results of this study revealed that females were high prevalent than males with 28.4% and 18.5% respectively, this could be due to that females pass long out of door at night in domestic works. The high level of malaria was screened with 24.2% and *P. falcipalum* was the only type of malaria screened. The age groups resulted in high frequency of malaria was ranged from 1 to 10 years old with 43.1%, this could be due to that childhood ages are not enough immunized. Homestead locations from water bodies and condition of not close window/door at night are the main risk factors of malaria with 63.6% and 38%. The rate of malaria increased timely from 2013 to 2015 with 17.7%, 25.3% and 27.9% respectively.

Conclusion: Based to the findings from this study, particular teams could be trained for malaria eradication and make Rwanda free from malaria.

Keywords: Malaria, Muhororo hospital, diagnosis, all age group patients, *Plasmodium falcipalum*

INTRODUCTION

Malaria is a mosquito-borne infectious disease affecting humans and other animals caused by parasitic protozoans (a group of single-celled microorganisms) belonging to the Plasmodium type. Malaria causes symptoms that typically include fever, feeling tired, vomiting, and headaches. In severe cases it can cause yellow skin, seizures, coma, or death. Symptoms usually begin ten to fifteen days after being bitten. If not properly treated, people may have recurrences of the disease months later. In those who have recently survived an infection, re-infection usually causes milder symptoms. This partial resistance disappears over months to years if the person has no continuing exposure to malaria (Caraballo, 2014).

The mosquito bite introduces the parasites from the mosquito's saliva into a person's blood. The parasites travel to the liver where they mature and reproduce. Five species of Plasmodium can infect and be spread by humans. Most deaths are caused by *P. falciparum* because *P. vivax*, *P. ovale*, and *P. malariae* generally cause a milder form of malaria. The species *P. knowlesi* rarely causes disease in humans. Malaria is typically diagnosed by the microscopic examination of blood using blood films, or with antigen-based rapid diagnostic tests (Carter *et al.*, 2017).

Prevention of malaria may be more cost-effective than treatment of the disease in the long run, but the initial costs required are out of reach of many of the world's poorest people. The risk of disease can be reduced by preventing mosquito bites through the use of mosquito nets and insect repellents, or with mosquito control measures such as spraying insecticides and draining standing water. Several medications are available to prevent malaria in travelers to areas where the disease is common (Sabot *et al.*, 2010).

The disease is widespread in the tropical and subtropical regions that exist in a broad band around the equator. This includes much of Sub-Saharan Africa, Asia, and Latin America. In 2015, there were 296 million cases of malaria worldwide resulting in an estimated 731,000 deaths. Approximately 90% of both cases and deaths occurred in Africa. Rates of disease have decreased from 2000 to 2015 by 37%, (Modrzynska *et al.*, 2017).

The WHO estimates that in 2015 there were 214 million new cases of malaria resulting in 438,000 deaths. Others have estimated the number of cases at between 350 and 550 million for falciparum malaria (Olupot-Olupot & Maitland, 2013). The majority of cases (65%) occur in children under 15 years old (Murray *et al.*, 2012). About 125 million pregnant women are at risk of infection each year; in Sub-Saharan Africa, maternal malaria is associated with up to 200,000 estimated infant deaths yearly (Hartman *et al.*, 2010). There are about 10,000 malaria cases per year in Western Europe, and 1300–1500 in the United States (Taylor *et al.*, 2012). About 900 people died from the disease in Europe between 1993 and 2003 (Carter *et al.*, 2017). Both the global incidence of disease and resulting mortality has declined in recent years. According to the WHO and UNICEF, deaths attributable to malaria in 2015 were reduced by 60% from 2000 (Howitt *et al.*, 2012). In 2012, there were 207 million cases of malaria. That year, the disease is estimated to have killed between 473,000 and 789,000 people, many of whom were children in Africa (Bhatt *et al.*, 2015).

Malaria is presently endemic in a broad band around the equator, in areas of the Americas, many parts of Asia, and much of Africa; in Sub-Saharan Africa, 85–90% of malaria fatalities occur. An estimate for 2009 reported that countries with the highest death rate per 100,000 of population were Ivory Coast (86.15%), Angola (56.93%) and Burkina Faso (50.66) (Bhatt *et al.*, 2015).According to the WHO statistic, the report of malaria cases of malaria in Rwanda was 1.282.012 in 1990, 1.373.247in 1992, 371.550 in 1994, 1.145.759 in 1996, 1.279.581 in 1998, 915.916 in 2000 and 856.233 in 2003. The study conducted on the prevalence and risk factors of malaria among children in southern highland of Rwanda by Gahutu *et al.* (2011) showed that *P. falciparum* infection was identified on the prevalence of 5.5% of the children had malaria. PCR-based *P. falciparum* prevalence ranged between 0 and 38.5% in the villages, and was 21.4% in the health centre, and 14.9% in the hospital. In Ruhuha sector, there was screened the prevalence of 2.4% and 1.2% in country (Tuyishime, 2013). According to MoH (2014), Malaria case was increased by 68.6% due to poor quality of mosquito nets.

MATERIAL AND METHODS

Study design:

This was a retrospective and cross-sectional study on prevalence of Malaria among patients attended Muhororo hospital.

Site:

The study area was at Muhororo hospital located in Ngororero district. Ngororero district is one of the five districts that comprise Rwanda's Western Province.

Population:

During the period of three months, from January to March 2017. The 293 patients suspected to have malaria attended Muhororo hospital were tested and taken as cross-sectional data. Patients attended hospital in the last four years from 2013 to 2016 corresponding with 7380 patients were used for showing the valuation in prevalence of cases and were taken as retrospective source.

Ethical statement:

The study was processed after being approved by the ethics committee of Muhororo Hospital, the objectives, procedures and potential risks were carefully controlled according to the Standard Operating Procedures (SOPs). Personal data from study participants, all diagnostic results and all related information were kept strictly with high level of confidentiality and used for only academic purpose.

Sample size determination:

In the case of maximizing the accuracy of results, whole population corresponding with 7673 patients of this study were taken as sample size for malaria screening and among them 1637 patients were positive. While it was not easy to ask questions for every patient due to the fact that some of them were not able to respond, such as children and oldest patients, 126 patients were questioned for risk factors of malaria and among them 33 patients were positive.

Sample collection and smear preparation:

Before blood collection, slide was labeled with a unique lab code by using lead pencil or permanent marker pen. Protective latex gloves (powder free) were worn before starting blood collection and when handling slides, for personal protection and to avoid leaving oil on the slide that may interfere with the smear preparation. Always a new lancet was used for each patient. It was not agreed to re-use the lancets. Fourth finger was cleaned by cotton imbedded in 70% ethyl alcohol for removing wastes. Finger was dried by using dry cotton or gauze. Finger was picked with one motion; the first drop of blood was removed by using dry cotton and the second one was taken on a new slide.

Thin blood film was prepared similarly to that of the differential white-cell count. A clean spreader slide, held at a 45° angle, toward the drop of blood on the specimen slide, until the blood spreads along the entire width of the spreader slide. While holding the spreader slide at the same angle, was pushed it forward rapidly and smoothly, Waited until the thin films were completely dry before staining. All slides were applied on slide rack then covered by using Giemsa solution (diluted 1/10) for 25 minutes then washed by using the tap water. The slides were dried on the top of tray at the same time by protecting slides from dust and flies. This was followed by microscopic examination with the help of oil immersion.

Statistical analysis

The double entry data table was submitted to analysis by Microsoft-Excel 2010 and SPSS v 16.0 software for entry, code and sort. The positive cases were calculated and express in percentage (%). Chi-square test was used for hypotheses testing.

RESULTS

The level of malaria could be different between sexes due to the location or daily activities.

Table 1: Distribution of malaria by sex and age groups

	Total population	Positive cases	Prevalence (%)	P-value
Sex				
Males	124	23	18.5	
Females	169	48	28.4	0.05
Age groups				
[1-10[	51	22	43.1	
[10-20[	5	0	0	
[20-30[	72	19	26.4	0.001
[30-40[	106	15	14.1	
≥ 40	59	15	25.4	

The information from table 1 shows that both sex and almost all ages are suffering from malaria.

Table 2: Level of malaria among patients attended Muhororo hospital

Total population	Positive cases	Prevalence (%)
293	71	24.2

This table reveals that there high level of malaria in the region of Muhororo hospital.

Table 3: Distribution of risk factors of malaria

(n=126)

	Total population	Positive case	Prevalence (%)	P-value
Malaria history				
Agree	54	15	27.7	0.4
Disagree	72	18	25	
Economic class				
Class I	30	8	26.6	
Class II	28	10	35.7	0.5
Class III	59	14	23.7	
Class Iv	9	1	11.1	
Close window/door at night				
Agree	60	8	13.3	
Disagree	66	25	38	0.02
Possession of insecticide treated nets				
Agree	110	28	25.4	0.7
Disagree	16	5	31.2	
Homestead location from water bodies				
Agree	33	21	63.6	0.001
Disagree	93	12	13	

In the area of malaria many risk factors increase its rate due to the position of area such as altitude or water steam.

The following figure presents the variation in the rate of malaria from 2013 to 2016.

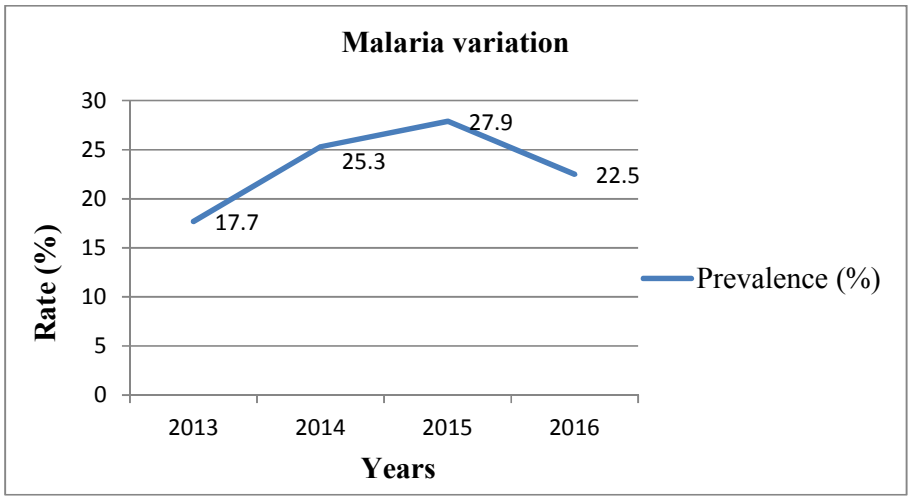

Figure 1: Distribution of variation of malaria rate timely

DISCUSSION

Malaria is a mosquito-borne infectious disease which is widespread in the tropical and subtropical regions that exist in a broad band around the equator. This includes much of Sub-Saharan Africa, Asia, and Latin America. In our study, we found that both sex and almost all ages are suffering from malaria. This could be due to the fact that everybody can be infected in the high risk zone. In this study females were high prevalent than males with 28.4% and 18.5% respectively. This could be due to life style of females such as pregnancy exposes them to malaria due to slowing down of immunity during pregnancy. These findings are in the same agreement with those of Jenkins *et al.* (2015), in Maseno, Kenya said that malaria was 28% and females were 50% more likely to have malaria than men. In this study the age groups resulted in high frequency of malaria was ranged from 1 to 10 years old with 43.1%. This could be due to the long time spent outside by children playing at night and also children may not respect the use of mosquito nets. Many other studies agree with this finding; Namanya (2013), said that 70% of malaria's worldwide death are children under the age of 5 years old and occur in sub-Sahara Africa, the majority of cases 65% occur in children under 15 years old (Murray *et al.*, 2012). This could be due to that children are not yet getting high level of immunity and sub-Sahara Africa is endemic region for malaria. Current study showed that malaria remains a major cause of morbidity in children in sub-Saharan Africa with 10% of all deaths of children under the age of 5 years due to malaria. This is equivalent to one child in sub-Saharan Africa dying of malaria every 2 min (Lopez *et al.*, 2016). In Uganda, malaria contributes to approximately 13% of under-five mortality (Roberts & Matthews, 2016). This level of death caused by malaria may be due to that Uganda located in the region of high endemic where the life of malaria vector is favorable.

In this study we observed that there high level of malaria in the region of Muhororo hospital. This could be due to geographical location of this area such as temperature that facilitates life of malaria vector. The results of this study show high level of malaria with 24.2%. This may be increased by the lack of vector control. This result is not goes beyond of other studies, the study of Namanya (2013), confirmed that 90% of worldwide deaths due to malaria occur in sub-Saharan Africa because of high level of poverty limit the care of eradicating malaria and this is the region more favorite for vector. Malaria is presently endemic in a broad band around the equator, in areas of the Americas, many parts of Asia, and much of Africa with 85–90% of malaria fatalities (Diallo *et al.*, 2017). This is because of socio-economic, demographic, and environmental factors.

In India, reports suggested that mortality in complicated *P. falciparum* malaria in Vellore in the southern state of Tamil Nadu was 7.9%, this prevalence was dawn level because India is a developed country and has high level of preventing malaria compared to East Africa. Whereas in Jabalpur (Madhya Pradesh) and Rourkela (Orissa), it was 25.6% and 30%, respectively (Woyessa *et al*., 2017). This is similar to the present study. In India, maximum malaria is contributed by the Orissa state with 3.5% (Ghanchi *et al*., 2016). An estimate for 2009 reported that countries with the highest death rate per 100,000 of population were Ivory Coast with 86.15%, Angola with 56.93% and Burkina Faso with 50.66% (Diallo *et al*., 2017). In Nigeria, 35.7% were positive at the General Hospital Makarfi, Makarfi Kaduna–State, North-Western Nigeria (Umaru & Uyaiabasi, 2015). The prevalence of malaria was 50% in Mauritania 30% in Guinea Bissau, 31% in Mali and 23% in Senegal (Ba *et al*., 2016). The number of persons infected by malaria in the household was increased by 5.1% in Ethiopia (Ayele *et al*., 2012). Malaria is the leading cause of morbidity in Uganda with 90–95% of the population at risk (Roberts & Matthews, 2016). This may be due to low level of sanitation in developing countries.

This study showed that homestead located near water bodies, which do not close windows/doors at night, malaria history, economic class without nets treated with insecticide are the risk of malaria with 63.6, 38, 27.7, 35.7, and 31.2% respectively. These are the cause of malaria because all are favorite for vector. There are other studies confirmed these, such as these of Chirebvu *et al*. (2014), in the study conducted in Botswana the risk factors of malaria were 53.5% of the respondents said that they had suffered from malaria within the past 8 months while 46.5% suffering from malaria more than one time. This may be due to poor treatment. 76.1% indicated that they had other residential homesteads elsewhere outside home. 98.6% experienced mosquito bites. 93% of respondents reported that they opened doors in the morning whilst 7% during the day. 97.2% they closed doors in the evening. This can be caused by poor region where houses are not well equipped.

The rate of malaria varies due to many factors such climate change or failure in implementation of the measurements of malaria eradication. This study shows that the rate of malaria was increased between 2013 and 2015. This could be due to the failure of eradication measurement reported during this period. In this study, the results revealed that, the rate of malaria increased timely from 2013 to 2015 with 17.7%, 25.3% and 27.9% respectively. This may be due to some inadequate measurements such as unavailability of mosquito nets. According to the WHO and UNICEF, deaths attributable to malaria in 2015 were reduced by 60% from 2000 (Howitt *et al*., 2012). This is because of implemented effort in malaria eradication. The study revealed that in Rwanda, in late 1987 malaria incidence in the area was increased by 37% over the 3 previous years (Loevinsohn, 1994). According to biomedical laboratory center, the number of malaria cases in Rwanda increased by 26% in 2014. It could be due to irresponsibility of people to eradicate Malaria.

CONCLUSION

The main objective of this study was to evaluate the prevalence of malaria among patients attended Muhororo hospital. *P. falcipalum* was the only type of malaria specie screened. There was high rate of malaria in subject studied. Due to location of homesteads near of water bodies, not closing windows/doors at night, poor treatment of Malaria, emergence of drug resistance and use of nets without insect sides were the risk factors associated with malaria. The rate of malaria increased timely in the catchment area of Muhororo hospital. The periodic follow up of implemented measurements of malaria eradication could be taken under consideration in the case of putting in history of malaria disease in Rwanda.

RECOMMENDATIONS

This study revealed that the rate of malaria was increased with time due to various conditions typically involved unawareness of population on implemented measures of malaria eradication, therefore certain measures like following the guidance of health care accordingly, assist people in the action of malaria eradication and increase awareness on prevention measures of malaria need to be taken into consideration in order to reduce the mortality rate due to malaria, and this can contribute to complete eradication of malaria in Rwanda.

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