Evolution of Malaria at Butare University Teaching Hospital (Buth) From 2006 to 2010

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Abstract

Background: Malaria is the leading cause of morbidity and mortality in Rwanda, particularly among children under 5 years and pregnant women. The objective of this retrospective study was to evaluate the evolution of malaria from 2006 to 2010 at Butare University Teaching Hospital (BUTH). **Methods:** Data were collected from registers of the Parasitology unit of BUTH and the following parameters were recorded: Age, sex, date of the test and result of the test. **Results:** *Plasmodium falciparum* was the most prevalent covered by 92.08%. The year 2006 had the highest prevalence 57.25 % of malaria, followed by 2010 with 19.50%, 2009 with 1 8%, 2008 with 7.35% and then the year 2007 accounted for 6.73%. January had the highest prevalence (17.62%) of malaria, followed by February with 17.26%, March with 14.08%. August had the lowest prevalence of malaria parasites with 3.39%. The age group of 21 to 30 years had the highest prevalence of malaria parasites with 47.24% followed by the age group of 0-10 with 26.43%. Malaria was more prevalent in male (64.03 %) than in female (35.97 %). **Conclusion:** The authors of this study recommend that the Government of Rwanda continue its considerable effort to control malaria. The mobilization of the whole population to subscribe to the community health insurance (mutuelle) will have a positive impact to eradicate malaria. The increase of preventive measures by sensitisation of the population especially in the early dry seasons is recommended. The effort of the Government to fight malaria in children below the age of 5 years and pregnant women must continue but as this study showed, male also must not be left behind in the sensitization in the fight against malaria.

KEYWORDS: Malaria, Evolution, Butare University teaching Hospital.

I. INTRODUCTION

Malaria is estimated to kill more than 1 million people annually, the majority of whom are young children. Children under 5 years of age and pregnant women are the worst affected by malaria and is one of the leading causes of death among young children. Ninety per cent of malaria cases in the world occur in Africa south of the Sahara (1). In Africa, malaria is understood to be a disease of poverty and cause of poverty (2). Annual economic growth in countries with high malaria transmission has historically been lower

than in countries without malaria (3, 4). Anemia due to malaria occurs in 50 percent of schoolchildren in Africa. Schoolchildren with anemia score more poorly on tests of education and the ones who had been hospitalized with cerebral malaria are 4.5 times more likely to suffer from mild to severe learning difficulties three to four years late (5, 6, 7, 8). During pregnancy malaria causes severe maternal illness and anemia, although there are disagreements on its effect on low birth weight among newborn infants, a leading risk factor for infant mortality (9, 10, 11).

In Rwanda, malaria is the leading cause of morbidity and mortality particularly among children under 5 years and pregnant women. The Ministry of Health of Rwanda has made considerable efforts to control malaria and this led to positive results. Statistics indicate that between 2005 and 2010, Rwanda has registered great success in the fight against malaria with a declining incidence of 70%, and the malaria prevalence at 2.1% according to the Demographic Health Survey (12). To support and maintain that progress we need to concentrate on monitoring and predicting malaria incidence. The objective of this retrospective study was to evaluate the evolution of malaria from 2006 to 2010 at Butare University Teaching Hospital (BUTH).

II. MATERIAL AND METHODS

This retrospective study was carried at Butare University Teaching Hospital (BUTH) located in the southern province in Huye District. This is one of the three reference hospitals in Rwanda. It receives patients from Southern Province and all over the country including students of the National University of Rwanda. Patients' demographic data on age, sex, year of test and test results were collected retrospectively from malaria registers of the parasitology unit of BUTH to evaluate the evolution of malaria from 2006 to 2010. Data entry, graphs and tables were done using Microsoft Excel.

RESULTS

Plasmodium falciparum was the most prevalent with 92.08%, followed by *Plasmodium malariae* with 3.75%, *Plasmodium ovale* with 3.49% and then *Plasmodium vivax* with 0.68% (See Figure 1).

Table 1 shows the evolution of malaria from 2006 to 2010 at BUTH. The year 2006 had the highest prevalence of malaria parasites with 57.25 %, followed by 2010 with 19.50 %, 2009 with 1 8%, 2008 with 7.35% then the year 2007 accounted for 6.73%.

January had the highest prevalence of malaria parasite with 17.62 %, followed by February with 17.26%, March with 14.08%, May with 9.49% and August had the lowest prevalence of malaria parasites with 3.39% (See Figure 2).

The age group of 21 to 30 years had the highest prevalence of malaria parasites with 47.24% followed by the age group of 0-10 with 26.43%, the age group of 11-20 years with 11.26% and then the group of 31-40 with (8.81%) (See Table 2).

Malaria was more prevalent in male than in female, with 64.03% and 35.97% positive cases respectively (Table 3).

III. DISCUSSION AND CONCLUSION

The main purpose of this study was to evaluate the evolution of malaria from 2006 to 2010 at Butare University Teaching Hospital (CHUB). *Plasmodium falcifarum* was the most prevalent with 92.08 %, followed by *Plasmodium malariae* with 3.75 %, *Plasmodium ovale* with 3.49 % and *Plasmodium vivax* with 0.68 %. A study done in Nigeria showed that 93.3 % of the study group had *Plasmodium falcifarum*, 3 % had *Plasmodium malariae* and 3.7 % had both species *Plasmodium falcifarum* and *Plasmodium malariae* (13). *Plasmodium falciparum* is a major cause of morbidity and mortality throughout the tropics. It causes 90% of malaria cases in Africa and is the cause of over 2-3 million (mostly children) people in the world mainly Africa (14).

In this study, a significant decrease (from 57.25 % to 6.73 %) of the frequency of malaria was observed from 2006 to 2007, then a slight increase was observed in 2008 and 2009 with 7.35 % and 9.18 % respectively. In 2010 a jump of the prevalence of malaria (19.50 %) was observed again. The significant decrease of malaria in 2007 is certainly due to the effort made by the ministry of health of Rwanda to control malaria. These include the distribution of free insecticidal treated mosquito bed nets to vulnerable group, early diagnosis, availability of anti malarial drugs, preventive treatment during pregnancy and indoor residual spraying (15, 16). The increase of incidence of malaria after 2007 may be due to the progressive adhesion rate of the population to the community based health insurance (CBHI). CBHI facilitates financially people to go to health centers and therefore their malaria status known. It allows the most vulnerable and poorest part of the population to be fully integrated into the health insurance system (17).

Climate affects both parasites and mosquitoes. Rainfall expands breeding grounds, and in many tropical areas, malaria cases increase during the rainy season. Therefore, environmental factors that affect mosquito survival can influence malaria incidence (14, 18, 19, 20, 21). In this study January had the highest prevalence of malaria with 17.62 %, follwed by February with 17.26, March with 14.08 % and August with the least prevalence of malaria with 3.39 %. Malaria was more prevalent in early dry seasons (January and February) because the temperature facilitates mosquitoes life cycle and rainfall to facilitates bleeding while August which is the very dry season in Rwanda, cases of malaria were very few. All mosquitoes begin their life cycle in water when adult female lays eggs in smoll pool standing water but at the temperature bellow 15.6 Celcius degree they don't develop at all (22).

The age group of 21-30 years was the most affected by malaria with 47.24%, followed by the age group of 0-10 years with 26.43%. Similar results were reported by Muddaiah and Prakash (23). In a study conducted in the eastern part of Rwanda the age group of 5-15 years was the most affected by Malaria (24). In Children below the age of 5 years and pregnant women, the immunity is lower which makes them being at high risk of malaria (25). In this study, male were more luckly to have malaria than female. These results are supported by previous studies (19, 26). This may be explained by the fact that female are more obedient on rules against the fight of malaria than male and also by the fact that male spend more time outside (late night) than female where the anoephele mousquito is active.

Despite the tremendous achievements realized by the Government of Rwanda against malaria, there is still more to do to eradicate this disease. We recommend that the Government continue its considerable effort to control malaria. The mobilization of the whole population to subscribe to the community health insurance (mutuelle) will have a positive impact in this regard. The increase of preventive measures by sensitisation of the population especially in the early dry seasons (January, February and March) is to recommend. The effort of the Government to fight malaria in children below the age of 5 years and pregnant women must continue but as this study showed, male also must not be left behind in the sensitization in the fight against malaria.

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REFERENCES

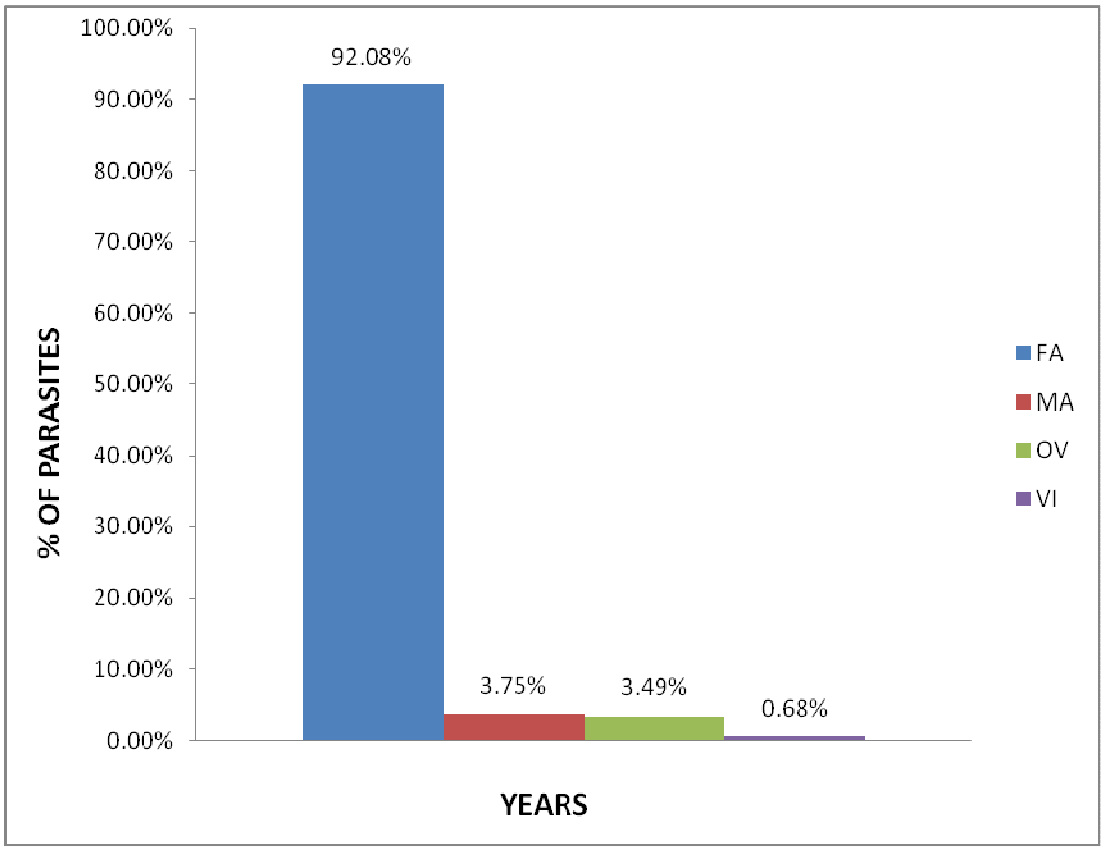
1. WHO (2013) Word Malaria Report 2012.
2. DE CASTRO M and FISHER MONICA G. **Is malaria illness among young children a cause or a consequence of low socioeconomic status? evidence from the united Republic of Tanzania**. *Malaria Journal* 2012, 11**:** 161-161.
3. TEKLEHAIMANOT A and PAOLA MEJIA A. **Malaria and Poverty**. *Annals of the New York Academy of Sciences* 2008, 1136**:** 32-37.
4. WORRALL E, BASU S and HANSON K. **Is malaria a disease of poverty? A review of the literature**. *Tropical Medicine & International Health* 2005, 10**:** 1047-1059.
5. BREMAN JG, E. A., KEUSCH GT (Ed.) (2001) ***Impact of Plasmodium falciparum Malaria on Performance and learning: Review of the Evidence.***, Holding PA, Snow RW.
6. CARTER JA, ROSS AJ, NEVILLE B G, OBIERO E, KATANA K, MUNG'ALA-ODERA V, LEES JA and NEWTON C R. **Developmental impairments following severe falciparum malaria in children**. *Trop Med Int Health* 2005, 10**:** 3-10.
7. KIHARA M, CARTER JA and NEWTON C R. **The effect of Plasmodium falciparum on cognition: a systematic review.** *Trop Med Int Health* 2006, 11**:** 386-97.
8. FERNANDO D, DE SILVA D, CARTER R, MENDIS KN and WICKREMASINGHE R. **A randomized, double-blind, placebo-controlled, clinical trial of the impact of malaria prevention on the educational attainment of school children.** *Am J Trop Med Hyg* 2006, 74**:** 386-93.
9. OLADEINDE BH, OMOREGIE R, ODIA I. and OLADEINDE OB. **Prevalence of Malaria and Anemia among Pregnant Women Attending a Traditional Birth Home in Benin City, Nigeria.** *Oman medical journal* 2012, 27**:** 232-236.

10. ALI AH, NEAL A and TOM S. **Maternal malaria during pregnancy and infant mortality rate: critical literature review and a new analytical approach.** *Journal of Vector Borne Diseases* 2007, 44**:** 98-104.
11. KANG, KREUELS B, ADJEI O, KRUMKAMP R, MAY J and SMALL DS. **The causal effect of malaria on stunting: a Mendelian randomization and matching approach**. *Int J Epidemiol* 2013, 8:7.
12. NATIONAL INSTITUTE OF STATISTICS OF RWANDA (NISR) [RWANDA], M. O. H. M. R., AND & ICF INTERNATIONAL. 2012. **Rwanda Demographic and Health Survey 2010.**Calverton, Maryland, USA:NISR, MOH, and ICF International.
13. Igbeneghu C and Odaibo AB. 2012. Plasmodium Species among the Inhabitants of Iwo Community, Southwestern Nigeria. American-Eurasian Journal of Scientific Research 2012, 7 (3): 118-122.
14. MAUDE R, HASAN M, HOSSAIN M, SAYEED A, KANTI PAUL S, RAHMAN W, MAUDE R, VAID N, GHOSE A, AMIN R, SAMAD R, YUNUS E, RAHMAN M, BANGALI ABDUL M, HOQUE M, DAY NICHOLAS PJ, NICHOLAS JW, WHITE LISA J, DONDORP ARJEN M. and FAIZ M. (2012) **Temporal trends in severe malaria in Chittagong, Bangladesh**. *Malaria Journal* 2012, 11**:** 323-323.
15. Roll Back Malaria: The global malaria action plan. For a malaria-free world Geneva, Switzerland; 2008.
16. Griffin JT, Hollingsworth TD, Okell LC, Churcher TS, White M, Hinsley W, Bousema T, Drakeley CJ, Ferguson NM, Basáñez MG, Ghani AC. **Reducing Plasmodium falciparum malaria transmission in Africa: a model-based evaluation of intervention strategies**. PLoS Med. 7:e1000324.
17. Rwanda Community Based Health Insurance policy. Ministry of Health: 2010.
18. YEWHALAW D, GETACHEW Y, TUSHUNE K, MICHAEL KW, KASSAHUN W, DUCHATEAU L and SPEYBROECK N. **The effect of dams and seasons on malaria incidence and anopheles abundance in Ethiopia.** *BMC Infect Dis* 2013, 13**:** 161.
19. LI T, YANG Z and WANG M. **Temperature, relative humidity and sunshine may be the effective predictors for occurrence of malaria in Guangzhou, southern China, 2006-2012.** *Parasit Vectors* 2013, 6**:** 155.
20. DEVI NP and JAUHARI RK. **Climatic variables and malaria incidence in Dehradun, Uttaranchal, India.** *Journal of Vector Borne Diseases* 2006,, 43**:** 21-28.
21. WOYESSA A, DERESSA W, ALI A and LINDTJORN B. **Malaria risk factors in Butajira area, south-central Ethiopia: a multilevel analysis.** *Malar J* 2013, 12**:** 273.
22. Pemola N and Jauhari RK. **Climatic Variables and malaria incidence in Dehradum, Uttaranchal, India.** *J Vect Borne Dis* 2006. 43 (3): 21-28.
23. MUDDAIAH M and PRAKASH PS. **A study of clinical profile of malaria in a tertiary referral centre in South Canara.** *Journal of Vector Borne Diseases* 2006, 43**:** 29-33.
24. RULISA S, KATEERA F, BIZIMANA JP, AGABA S, DUKUZUMUREMYI J, BAAS L, DE DIEU HARELIMANA J, MENS PF, BOER KR and DE VRIES PJ.

Malaria prevalence, spatial clustering and risk factors in a low endemic area of eastern rwanda: a cross sectional study. 2013, *PLoS One*, 8**,** e69443.

25. HUSSAIN K, SHAFEE M, KHAN N, JAN S, TAREEN A and KHAN M. **Seroprevalence of pediatric malaria in quetta, balochistan, pakistan.** *Iran J Parasitol* 2013, 8**:** 342-7.
26. AYDIN MF and SAHIN A. (2013) **Malaria epidemiology in mersin province, Turkey from 2002 to 2011.** *Iran J Parasitol* 2013, 8 **:** 296-301.

Figure1.Malaria parasites result



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FA= (*Plasmodium falciparum*), MA= (*Plasmodium malariae*), VI= *(Plasmodium vivax),* OV= *(Plasmodium ovale).*

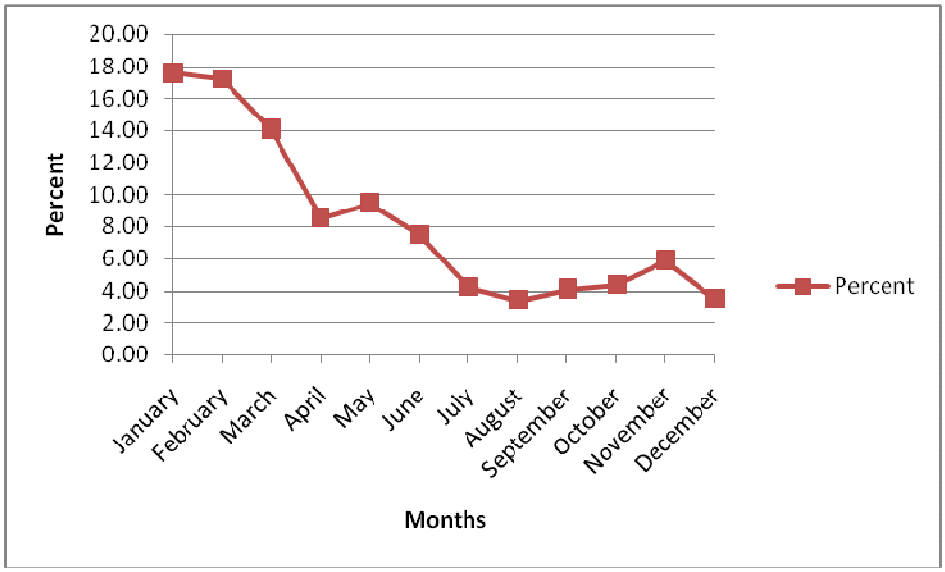

Figure 1 :Monthly cases of malaria in percentage from 2006 to 2010

Table 1. Evolution of malaria from 2006 to 2010 at CHUB

Parasites / years	FA	MA	OV	VI	Total
2006	50.94%	3.18%	2.76%	0.36%	57.25%
2007	6.26%	0.21%	0.21%	0.05%	6.73%
2008	7.19%	0.10%	0.00%	0.05%	7.35%
2009	8.86%	0.10%	0.16%	0.05%	9.18%
2010	18.82%	0.16%	0.36%	0.16%	19.50%
Total	92.08%	3.75%	3.49%	0.68%	100.00%

Table 2. Distribution of malaria cases according to age group

Result						
AGE	FA	MA	OV	VI	Total	Total %
0-10	477	13	13	4	507	26.43%
11-20	199	10	4	3	216	11.26%
21-30	824	35	43	4	906	47.24%
31-40	152	9	7	1	169	8.81%
41-50	47	0	0	0	47	2.45%
51-60	36	3	0	0	39	2.03%
61-70	14	2	0	1	17	0.89%
71-80	13	0	0	0	13	0.68%
81-90	3	0	0	0	3	0.05%
Total	1766	72	67	13	1918	100%

Table 3. Distribution of malaria cases according to gender

Result						
Sex	FA	MA	OV	VI	Total	Total%
F	643	19	25	3	690	35.97 %
M	1123	53	42	10	1228	64.03 %
Total	1766	72	67	13	1918	100 %