Prevalence, Control and Treatment of Malaria in Some Urban Hospitals of Kaduna, Kaduna State, Nigeria

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ABSTRACT
Malaria is one of the most severe global health problems, particularly in sub-Saharan Africa, where Nigeria has the greatest number of malaria cases (Dawaki et al, 2016). In this study, the prevalence, control and treatment of malaria in five general hospitals in Kaduna metropolis were investigated to provide epidemiological data on malaria.
Secondary data of malaria cases between January 2013 and December 2014 were used. Interviews were conducted with Doctors, Pharmacists and Nurses for treatment pattern and control measures used.
Multi factor ANOVA and Tukey HSD (Honestly Significant Difference) post hoc test were used to analyse the data. Results indicated significant differences in malaria prevalence by hospitals and age groups ($p = 0.001$). There were no significant differences in malaria prevalence in the five hospitals by year ($p = 0.329$).
Control measures used in all the hospitals included: Long-Lasting Insecticide Treated Nets, Indoor Residual Spraying, and Intermittent Preventive Treatment for pregnant women and weekly health talks for all patients attending the hospitals. Drugs of choice for treatment of uncomplicated malaria were ACTs, while Artesunate, Artemether, Arteether or Quinine injection followed by oral ACTs were commonly used for severe malaria.
The differences in malaria prevalence in the hospitals could be attributed to differences in socio-economic and environmental factors.

Keywords: *Control, malaria, prevalence, treatment, urban*

1. INTRODUCTION:

Malaria causes significant human suffering and impact on social and economic development (Adedotun, 2012). The World Health Organization (WHO) estimated that there were 214 documented cases of malaria in 2015, resulting in the death of about 438,000 people. About 90% of these deaths occurred in WHO African region, followed by the WHO South-east Asia region (7%) and the WHO Mediterranean region (2%). Children less than 5 years of age accounted for 306,000 (70%) of total mortality (WHO, 2015).
There is a general consensus that urbanization will lead to decreased malaria transmission. One recent modelling study predicts a 53.5% reduction in malaria transmission by 2030, largely due to expected demographic changes (Saugeon *et al*., 2009). It is thought that

urbanization lead to improved infrastructure, better-quality "mosquito-proof"' housing, increased access to healthcare and a reduction in vector breeding sites. Malaria vector species are known to prefer clean water for breeding, which is difficult to come by in polluted urban areas, and the higher ratio of humans to mosquitoes is also thought to lead to a decreased human biting rate (Klinkenberg *et al*., 2008). However, despite these encouraging factors, malaria transmission persists in African cities and, in some cases, at even higher levels than in surrounding areas (Matthys *et al*., 2006).

The case management of malaria in Nigeria includes the following: use of Artemisinin-based Combination Therapies (ACTs); Insecticide-Treated Nets (ITN, LLIN) and other vector control measures (e.g. Indoor Residual Spraying (IRS), environmental management and larvicidal control; providing Intermittent Preventive Therapy (IPT) for pregnant women with Sulphadoxine-Pyrimethamine (SP); and improving malaria epidemic preparedness and response (FMOH, 2014). Artemether-Lumefantrine, Artemether-Amodiaquine or other Artemisinin-based combinations are used as first-line treatment for uncomplicated malaria cases. Quinine, Artesunate, Artemether or α-β Arteether injections are used for treatment of severe *P. falciparum* malaria infection. Quinine injection and Clindamycin are used for treatment of malaria in pregnancy.

Kaduna metropolis has an estimated population of 1.3 million (2006 Population Census). The residents of Kaduna are mostly civil servants, company workers, traders, Artisans and Students. Kaduna has two climatic conditions. The raining season is between May and October, while the dry season lasts from November to April.

The Urban Hospitals were: General Hospital, Kawo (GHK) and Barau Dikko Teaching Hospital- KASU (BDTH) located in Kaduna North LGA; Yusuf Dan Tsoho Memorial Hospital (YDMH), General Hospital, Sabon Tasha (GHST) and Gwamna Awwan General Hospital (GAGH) located in Kaduna South LGA.

The aim of this study is to determine the prevalence of malaria in the some hospitals in Kaduna metropolis and to identify the control measures and treatment used for malaria.

2.0 METHOD

2.1 Conceptual Framework

This study was based on the assumption that prevalence of malaria in urban communities of Kaduna state is influenced by patient's environment, socio-economic status, location and age.

2.2 Data Collection

The data collected for this study were monthly numbers of patients treated for malaria in five urban hospitals of Kaduna metropolis from January 2013 to December 2014. The hospitals were chosen by their locations for geographical spread and to reflect the socio-economic distribution of the population in Kaduna. Equivalently, the choice of two years, 2013 and 2014, was based on availability and consistency of data from the various hospitals and for the purpose of comparison of prevalence over time.

Interviews were also conducted in these hospitals with doctors, pharmacists and nurses to find out the treatment and control measures used for malaria.

2.3 Method for Data Analysis

Multifactor Analysis of Variance (ANOVA) without interaction was used to determine whether a factor (or an independent variable) has a significant effect on a response (dependent variable).

Where the result of Multifactor ANOVA indicated a significant difference in prevalence of malaria due to one or more factors such as hospitals, location, year or age, Tukey Honestly Significant Difference (HSD) post hoc test was used to do an all pair-wise comparisons to

identify the exact locations and magnitude of the differences. The significant level was fixed at $p \leq 0.05$.

3.0 RESULTS

Tables 1 and 2 summarized the percentage prevalence of malaria in the hospitals for 2013 and 2014. The highest prevalence in 2013 was recorded in GHST (17.3%), while the lowest was in GHK (9.4%). While the highest prevalence in 2014 was in YDMH (32.6%) and the lowest was in GAGH (5.3%). There was no data of malaria cases for children under 5 years in BDTH for 2014 (Tables 1 and 2).

TABLE 1: PERCENTAGE MALARIA PREVALENCE IN URBAN HOSPITALS (2013)

	URBAN HOSPITALS				
MONTHS	**BDTH**	**GAGH**	**GHK**	**GHST**	**YDMH**
JAN	24.6	ND	12.2	ND	15.6
FEB	16.4	ND	7.1	ND	12.6
MAR	24	ND	4.9	ND	13.2
APR	7.4	ND	37.3	0.4	14.5
MAY	21.1	ND	14.7	14.9	9.9
JUN	15.5	ND	9.6	13.4	14.9
JUL	7.8	ND	4	56.7	8.7
AUG	6.7	ND	8.9	ND	14.2
SEPT	5.1	ND	13.7	14.8	9.1
OCT	5.4	ND	62.9	9.7	6.8
NOV	7.2	ND	3.5	10.8	9.7
DEC	5	ND	ND	17.8	10.1
AVM	13.6	ND	9.4	17.3	11.6

BDTH = Barau Dikko Teaching Hospital; GAGH = Gwamna Awwan General Hospital; GHK = General Hospital Kawo; GHST = General Hospital Sabon Tasha; YDMH = Yusuf Dantsoho Memorial Hospital. ND = No Data

TABLE 2: PERCENTAGE MALARIA PREVALENCE IN URBAN HOSPITALS (2014)

	URBAN HOSPITALS				
MONTHS	**BDTH**	**GAGH**	**GHK**	**GHST**	**YDMH**
JAN	2.5	9.9	ND	9.3	9.3
FEB	1.2	6.3	9	7.5	16.4
MAR	0.3	ND	34.4	1.3	6.5
APR	0.2	5.6	12.2	6.5	12.6
MAY	0.4	11.5	10.5	6.1	11.2
JUN	0.6	4.4	0.5	4.2	5.7
JUL	0.4	1.1	14.8	3.2	16.7
AUG	0.03	0.6	8.5	3.6	23.7
SEPT	0.3	ND	22.2	4.8	43.9
OCT	0.5	ND	5.3	4.4	50.4

NOV	0.1	ND	1.7	ND	54.4
DEC	0.9	ND	7.4	ND	60.4
AVM	0.5	5.3	8.8	5.4	32.6

BDTH = Barau Dikko Teaching Hospital; GAGH = Gwamna Awwan General Hospital; GHK = General Hospital Kawo; GHST = General Hospital Sabon Tasha; YDMH = Yusuf Dantsoho Memorial Hospital. ND = No Data

The result indicated a statistically significant difference in malaria by hospitals ($p = 0.021$). Tukey HSD post hoc analysis showed a significant higher prevalence of malaria in YDMH than in BDTH (diff = 12.369, $p = 0.014$). There were no statistically significant differences in all other pair-wise comparison amongst the hospitals ($p > 0.05$). There was no statistically significant difference in malaria prevalence by year ($p = 0.136$). Malaria prevalence in individuals above 5 years of age was statistically significantly higher ($p = 0.001$) than in those below 5 years (Tables 3, 4, 5 and 6)

TABLE 3: PERCENTAGE MALARIA PREVALENCE IN CHILDREN UNDER 5 YEARS IN URBAN HOSPITALS (2013)

	URBAN	**HOSPITALS**			
MONTHS	**BDTH**	**GAGH**	**GHK**	**GHST**	**YDMH**
JAN	26.2	33.2	25.1	ND	57.5
FEB	46.4	35	42.2	ND	47.3
MAR	36.3	29.7	48.2	ND	58.9
APR	ND	24.9	34.6	100	49
MAY	44	60.3	49.7	14.2	45.3
JUN	15.9	38.6	65.8	15.9	46.4
JUL	ND	4.4	53.9	5	62.1
AUG	ND	48.2	60.9	ND	35.1
SEPT	ND	7.5	44.7	35	73.9
OCT	ND	10.8	21.8	23.8	89.3
NOV	ND	23.6	38.6	21.1	33.4
DEC	ND	56.6	ND	21	35.2
AVM	26.9	28.7	44.5	15.1	51.2

BDTH = Barau Dikko Teaching Hospital; GAGH = Gwamna Awwan General Hospital; GHK = General Hospital Kawo; GHST = General Hospital Sabon Tasha; YDMH = Yusuf Dantsoho Memorial Hospital. ND = No Data

TABLE 4: PERCENTAGE MALARIA PREVALENCE IN INDIVIDUALS ABOVE 5 YEARS IN URBAN HOSPITALS (2013)

	URBAN HOSPITALS				
MONTHS	**BDTH**	**GAGH**	**GHK**	**GHST**	**YDMH**
JAN	73.8	66.8	74.9	ND	42.5
FEB	53.6	65	57.8	ND	52.7
MAR	63.7	70.3	51.8	ND	41.1

APR	100	75.1	65.4	NIL	51
MAY	56	39.7	50.3	85.8	54.7
JUN	84.1	61.4	34.2	84.1	53.6
JUL	100	95.6	46.1	95	37.9
AUG	100	51.8	39.1	ND	64.9
SEPT	100	92.5	55.3	65	26.1
OCT	100	89.2	78.2	76.2	10.7
NOV	100	76.4	61.4	78.9	66.6
DEC	100	43.4	ND	79	64.8
AVM	73.1	71.3	55.5	84.9	48.8

BDTH = Barau Dikko Teaching Hospital; GAGH = Gwamna Awwan General Hospital; GHK = General Hospital Kawo; GHST = General Hospital Sabon Tasha; YDMH = Yusuf Dantsoho Memorial Hospital. ND = No Data

TABLE 5: PERCENTAGE MALARIA PREVALENCE IN CHILDREN UNDER 5 YEARS IN URBAN HOSPITALS (2014)

	URBAN HOSPITALS				
MONTHS	**BDTH**	**GAGH**	**GHK**	**GHST**	**YDMH**
JAN	ND	61.5	61.2	24.5	43.6
FEB	ND	54.1	ND	19.4	46.9
MAR	ND	ND	60.6	50	53
APR	ND	29.7	39.2	23.7	24.1
MAY	ND	20.7	41.6	13.7	28
JUN	ND	8.5	40	18.1	23.7
JUL	ND	26.4	62	30.2	12.7
AUG	ND	2.8	27	13	16.8
SEPT	ND	ND	47.8	17.1	10.1
OCT	ND	ND	35.6	12.1	18.9
NOV	ND	ND	29.7	ND	17.2
DEC	ND	ND	77	ND	15.7
AVM	ND	34.4	49.5	11.4	18.7

BDTH = Barau Dikko Teaching Hospital; GAGH = Gwamna Awwan General Hospital; GHK = General Hospital Kawo; GHST = General Hospital Sabon Tasha; YDMH = Yusuf Dantsoho Memorial Hospital. ND = No Data

TABLE 6: PERCENTAGE MALARIA PREVALENCE IN INDIVIDUALS ABOVE 5 YEARS IN URBAN HOSPITALS (2014)

	URBAN HOSPITALS				
MONTHS	**BDTH**	**GAGH**	**GHK**	**GHST**	**YDMH**
JAN	100	38.5	38.8	75.5	56.4
FEB	100	45.9	100	80.6	53.1
MAR	100	ND	39.4	50	47
APR	100	70.3	60.8	76.3	75.9
MAY	100	79.3	58.4	86.3	72
JUN	100	91.5	60	81.9	76.3
JUL	100	73.6	38	69.8	87.3
AUG	100	97.2	73	87	83.2
SEPT	100	ND	52.2	82.9	89.9
OCT	100	ND	64.4	87.9	81.1
NOV	100	ND	70.3	ND	82.8
DEC	100	ND	23	ND	84.3
AVM	100	65.6	50.5	88.6	81.3

BDTH = Barau Dikko Teaching Hospital; GAGH = Gwamna Awwan General Hospital; GHK = General Hospital Kawo; GHST = General Hospital Sabon Tasha; YDMH = Yusuf Dantsoho Memorial Hospital. ND = No Data

TABLE 7: COMPARISON OF MEAN PERCENTAGE PREVALENCE OF MALARIA IN URBAN HOSPITALS (2013 and 2014)

NAME OF HOSPITAL	**MPP (2013)**	**MPP (2014)**
BDTH	13.6	0.5*
GAGH	ND	5.3
GHK	9.4	8.8
GHST	17.3	5.4
YDMH	11.6	32.6

BDTH = Barau Dikko Teaching Hospital; GAGH = Gwamna Awwan General Hospital; GHK = General Hospital Kawo; GHST = General Hospital Sabon Tasha; YDMH = Yusuf Dantsoho Memorial Hospital. * = Incomplete data; ND = No Data

Table 7 summarizes the mean prevalence of malaria in 2013 and 2014. Figure 1 shows the mean percentage positive MPS tests in the hospitals in 2013 and 2014. The results indicated a statistically significant difference in percentage positive MPS tests by hospitals ($p = 0.001$), except for the comparison between GAGH and BDTH ($p = 0.924$).

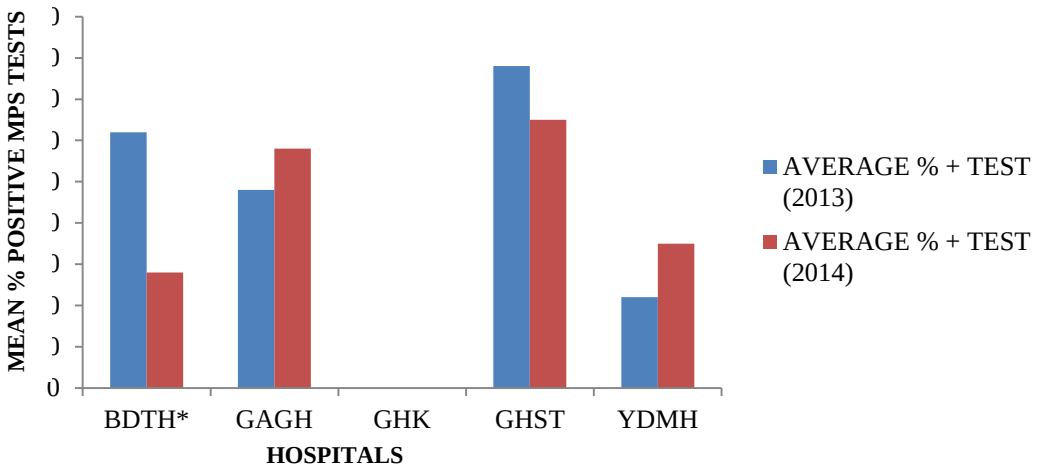

FIG 1: MEAN % POSITIVE MPS TESTS (2013 and 2014)

BDTH = Barau Dikko Teaching Hospital; GAGH = Gwamna Awwan General Hospital; GHK = General Hospital Kawo; GHST = General Hospital Sabon Tasha; YDMH = Yusuf Dantsoho Memorial Hospital. ND = No Data

DISCUSSION

The present study showed that there were statistically (p = 0.001) significant differences in the prevalence of malaria by hospital and age. The difference in prevalence was between YDMH and BDTH, with the former having higher malaria prevalence (diff = 12.370, p = 0.014). While YDMH is located in Tudun wada, a densely populated area in Kaduna, BDTH is located in the Government Reserved Area (GRA). The difference in the socio-economic status of the people of the two areas as well as differences in environmental factors may be responsible for the observed differences (Mourou *et al*., 2012; Onwujekwe *et al*., 2009) in their study on malaria transmission in Libreville, Gabon found that socio-economic factors contributed to increased transmission in poorer areas in slum-like conditions, and in the peri-urban areas of many cities. Better-quality housing also decrease the risk of malaria, as it minimizes entry point for mosquito during the night (De-Silva and Marshall, 2012). Hygiene, sanitation and waste collection are also key determinants of malaria transmission. The more the household dispose of waste properly, the lower the risk of liquid wastes collecting in pools of stagnant water and forming vector breeding sites (De-Silva and Marshall, 2012). The results showed that there were no statistically significant differences in malaria prevalence among all pair-wise comparisons among the hospitals (p > 0.05). This could be as a result of similarities in socio-economic status and environmental factors around these other four hospitals.

The results showed that there were no statistically significant differences in malaria prevalence by year (p = 0.329), however, percentage malaria prevalence in YDMH was 11.6% in 2013 compared to 32.6% in 2014. The high prevalence in YDMH in 2014 could be as a result of upsurge in malaria cases recorded between September and December (43.9 – 60.4%). In a similar way, GHST had 17.3% malaria prevalence in 2013 (probably due to the very high incidence of 56.7% in July 2013) compared to a lower value of 5.4% in 2014.

Malaria prevalence was statistically significantly different in the two age groups studied (p = 0.001), with the individuals above 5 years of age having higher prevalence. This may be attributed to greater exposure to mosquito bites by adults, who sometimes sleep outdoors during hot weathers. On the other hand, children mostly sleep indoors properly covered and under bed nets (Onyindo *et al*., 2011). This agrees with the work of Uneke *et al*., (2005), who

recorded higher prevalence among the older age groups in a similar in Jos, Nigeria and those of Ekpenyong and Eyo, 2008; Kalu *et al*., 2012; and Dawaki *et al*., 2016.

The study showed that there were no statistically significant differences in malaria prevalence by month ($p = 0.932$). This does not agree with the reported significant seasonal variation of infectivity rate in both urban and rural Kandi of north eastern Benin (Govoetchan *et al*., 2014).

The present study revealed that the control measures used in all the hospitals included: Long-lasting Insecticide Nets (LLINs), Indoor residual spraying (IRS) and Intermittent Preventive Treatment (IPT) in pregnant women using Sulphadoxine/Pyrimethamine and outdoor larvicidal spraying of stagnant waters and other possible breeding sites.

In all the urban hospitals in this study, Artemisinin Combination Therapies (ACTs) were the drugs of first choice in the treatment of uncomplicated malaria. Severe cases of malaria were treated with Artemether, Arteether, Artesunate or Quinine injections. These injections were usually followed by oral anti-malarial drugs such as ACT, Quinine, Clindamycin or Sulphadoxine/Pyrimethamine. This practice is in line with the Federal Ministry of Health National Guidelines (FMOH, 2015) for the treatment of malaria in Nigeria.

CONCLUSION

The findings in the present study indicated that the prevalence of malaria in the hospitals were statistically significantly different. There was also a significant difference in prevalence of malaria in children less than 5 years as compared to that of individuals above 5 years, with the latter group showing a higher prevalence. There was no statistically significant difference in malaria prevalence in the two year period of this study. All the five hospitals in this study adhere to the National Guidelines for the treatment of malaria.

LIMITATIONS

- Improper and inadequate record keeping. This could affect the inferences drawn from the data.
- No uniformity in the forms used to record malaria cases in the hospitals.
- Malaria cases in the data were based on clinical diagnosis and/or laboratory tests. Some treatments based on clinical diagnosis alone may not be malaria, but may have counted as such.
- The wide use of RDT in some of the hospital laboratories, even though a faster method of testing for malaria parasite, could give a false negative result, especially when the parasitaemia level is low.

RECOMMENDATIONS

- The hospital Records Departments and Laboratories should be completely computerized, so as to have complete and reliable data on patients.
- There is need for more education and enlightenment of the patients on proper use of LLINs, good environmental sanitation and use of Indoor and Outdoor Residual spraying.
- There is need to increase the capacity and supplies of microscopes and RDTs kits in hospitals.
- Need for increased mass media campaigns and health talks in the hospitals towards reducing incidence of malaria.
- Universities and Research Institutes should be encouraged and better funded to conduct more researches towards solving the malaria scourge.

DECLARATIONS

Compliance with ethical guidelines:

Permission to conduct this research was obtained from Kaduna State Ministry of Health Research and Ethics Committee.

Conflicting interest:

The authors declare that they have no conflict of interest.

Authors Contributions:

JAA and AZ designed, collected data and drafted the manuscript. DSH did the Statistical analysis of the data. JAA and AZ critically revised the manuscript for intellectual content. All Authors read and approved the final manuscript.

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