PREVALENCE OF MALARIA INFECTION IN CHILDREN IN ANAMBRA STATE, NIGERIA AFTER CHANGE OF POLICY FROM PRESUMPTIVE/CLINICAL TO CONFIRMED DIAGNOSIS

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ABSTRACT

In 2011, WHO change malaria case-management policy from presumptive treatment of fevers to parasitological diagnosis and targeted treatment with artemisinin combination therapy (ACTs). Between 2010 and 2012, a series of activities were undertaken to support the implementation of the new policy. Regular monitoring of the quality of malaria case-management was carried out to inform policy makers, implementers and donors agencies on the implementation progress. This study was carried out to estimate the effects of this new WHO policy on the prevalence of malaria parasite infection in children from selected communities in Anambra State, Nigeria. This study was conducted in thirteen communities purposively selected from thirteen local government areas in Anambra State using children aged 0 – 14.90 years. Venous blood samples were collected from 82 and 166 children from the communities and hospitals, respectively for thick films blood smears for microscopy. Chi-square (χ^2) and Fisher least significance difference test were used to analyse the data collected. The overall prevalence of malaria based on the community survey in Anambra State was 46.30 %, while the prevalence of malaria based on hospital survey was 94.60 %. The result of this study showed that there was no significant difference in infection rate in relation to age in both community and hospital survey. There should be proper management of childhood malaria in the homes and hospitals. This could be achieved by training and retraining of health care workers and mothers/care givers in the formal health care delivery systems to ensure quick and accurate diagnosis of malaria parasite infection of children in Anambra State, Nigeria.

Keywords: Prevalence of malaria, Children, Anambra State, Nigeria, Presumptive policy, Confirmed diagnosis, Hospital malaria vs. Community malaria

INTRODUCTION

Malaria is one of the most important causes of morbidity in the world. It is a vector borne infectious disease caused by a eukaryotic protista of the genus *Plasmodium*. The disease is transmitted by female *Anopheles* mosquitoes which carry infective sporozoite stage of *Plasmodium* parasite in their salivary glands (Akinleye, 2009). It is transmitted from person to person through the bite of a female *Anopheles* mosquito that is infected with one of the four species of *Plasmodium*: *Plasmodium ovale, Plasmodium falciparum, Plasmodium vivax and Plasmodium malariae.*

In Nigeria, malaria is holoendemic in the rural areas and mesoendemic in the urban areas. In the southern part of the country the transmission rate is approximately uniform throughout the year (Nwaorgu and Orajaka, 2011). Farming activities which takes place mostly during the rainy season period of the year favours the breeding of mosquitoes and this makes the effects of malaria apparently noticeable in rural areas due their proximity to farmlands (Kalu *et al*., 2012). The degree of malaria infestation varies from region to region in Nigeria (Onwuemele, 2014). Globally, the disease caused an estimated 453 000 under-five deaths in 2013. Between 2000 and 2013, an expansion of malaria interventions helped to reduce malaria incidence by 30 % globally, and by 34% in Africa. During the same period, malaria mortality rates decreased by an estimated 47% worldwide and by 54 % in Africa. In the under-five age group, mortality rates have declined by 53 % globally, and by 58 % in Africa (WHO, 2014). WHO noted that progress in adopting and rolling out preventive therapies for children has been even slower than ever. In 2013, only six of the 16 countries where WHO recommend preventive therapies for children under five have adopted the treatment as national policy. Only one country has adopted the recommended preventive therapy for infants (WHO, 2014).

The decline in malaria incidence and mortality may be attributed to the volume of RDT sales to the public and private sectors of endemic countries that increased from 46 million in 2008 to 319 million in 2013. Also the number of patients tested by microscopic examination increased to 197 million in 2013, with India accounting for over 120 million slide examinations and globally, 392 million courses of ACTs were procured by endemic countries in 2013, up from 11 million in 2005. In 2013 the total number of diagnostic tests (RDTs and microscopy combined) provided in the public sector in Africa exceeded the total number of ACTs distributed. This indicates a prominent shift away from presumptive treatment and is an encouraging sign (WHO, 2014). Therefore, study was carried out to estimate the effects of this new WHO policy on the prevalence of malaria parasite infection in children from communities in Anambra State.

MATERIALS AND METHODS

Study Area: The study was conducted in Anambra State. Anambra State is located in south-eastern Nigeria with a population of over 4 million people made up of 2,117,984 males and 2,059,844 females (NPC, 2006; MLS, 2010). Anambra State is made up of twenty one local government areas. This study was conducted in thirteen communities purposively selected from thirteen local government areas in Anambra State. The communities are; Umueri in Anambra East, Atani in Ogbaru, Awka in Awka South, Amanuke in Awka North, Enugu-Ukwu in Njikoka, Ifite-Dunu in Dunukaofia, Ekwulobia in Aguata, Agulu in Aniocha, Nnobi in Idemili, Umunya in Oyi, Osomala in Ogbaru, Onitsha in Onitsha South and Nnewi in Nnewi South Local Government Areas. The prevailing climatic conditions are high rainfall ranging from 1,400 mm in the north to 2,500 mm in the south with four months of dryness (November – February), constant high temperature and a mean of 30 % atmospheric humidity. The vegetation types are mangrove and freshwater swamps communities, rainforest, forest, savannah mosaic and derived savannah zone. The mainstay of the communities is subsistence agriculture and trading.

Study Population: Children aged 0 – 14.9 years from the sampled households in the communities and their counter parts that attended the outpatient clinics of the selected general hospitals in Anambra State were recruited into the study. The sampled communities and hospitals were visited twice monthly.

Sampling Technique: Stratified random sampling was used. All hospitalized or non-hospitalized patients (children 0 – 14.9 years) with acute febrile illness were randomly sampled two times in a month from April 2012 to March 2013. Fifty homes were randomly sampled by balloting in each of the 13 communities for 12 months.

Ethical Clearance and Exclusion Criteria: Ethical clearance was obtained from the University of Nigeria Teaching Hospital Ituku-Ozalla in Enugu State, with which permission was obtained from the management of the selected General Hospitals for the study.

Informed consent was obtained from the mothers/caregivers before the collection of blood samples and the administration of questionnaires.

Sample Collection: The research was conducted between the months of April 2012 to March 2013. With the help of the medical team, blood samples were collected from children whose mother consented according to Sood (2006). One (1) ml of venous blood was obtained from each sampled child after cleaning the site with spirit and put in labelled ethylenediamine tetra-acetic disodium acid (EDTA) vacutainers to avoid clotting and ensure preservation of the samples. The samples were kept in ice chips and taken to the laboratory for parasitological analyses. Venous blood samples were collected from 82 and 166 children from the communities and hospitals, respectively.

Preparation of Blood Smears for Microscopy: Thick film blood smears were prepared from the blood samples according to Sood (2006). Large drop of blood samples were deposited at one end of the slide and were spread out evenly with the corner of another slide to a diameter of about 20mm. They were put in distilled water for 10 minutes for dehaemoglobinisation, dried in a flat position to ensure even distribution of blood and stained with Gymea's stain for 20 minutes. The stain was washed out with buffered water of pH 6.8 and stood upright to dry in the air, and viewed under x 100 objective (oil immersion) lens. The thick smears were used to confirm the presence or absence of malaria parasite. The asexual forms of the parasite were counted in 200 leucocytes. The degree of parasitaemia were graded according to the number of parasite per micro litre thus, 1-999 (+), 1000-9999 (++) and >100000 (+++) (Cheesbrough, 2006). Negative blood samples served as control.

Statistical Analysis: The presence or absence of *Plasmodium* infection (prevalence) was calculated and the significant difference in prevalence across age groups for both community and hospital survey was determined using Chi-square (χ^2). The significant difference in the prevalence of infection for sex (community and hospital) was done using Fisher least significance for 2 x 2 tables. For all determination, the significant difference was set at $p<0.05$.

RESULTS

Characteristics of Studied Population: Children (asymptomatic and symptomatic) between the ages of 0 – 14.90 (4.12 ± 0.27) years were sampled from thirteen communities and eleven general hospitals in Anambra State. A total of 82 children were sampled in the communities which included 39(47 %) males and 43(53 %) females. One hundred and sixty six (166) children who attended the outpatient clinic of general hospitals/comprehensive health centres in Anambra State were sampled, comprising of 95(57.2 %) males and 71(42.8 %) females. The overall prevalence of malaria based on the communities surveyed in Anambra State was 46.3 %, while the prevalence of malaria based on hospitals surveyed was 94.6 %. The infection prevalence among the communities (Table 1) showed that Awka community had the highest prevalence (75 %) followed by Amanuke and Osomala (70 %), Umunya (66.7 %), Onitsha (50 %), Umueri and Ekwulobia (40 %), Ifitedunu (37.5 %), Atani and Agulu (33.3 %), Enugu-Ukwu and Nnewi (25 %) and Nnobi with the lowest prevalence of 20 %.

Table 1: Community prevalence of malaria in children in Anambra State, Nigeria

Variables	Number examined (n)	Number positive (%)
Communities		
Amanuke	10	07(70.0)
Awka	04	03(75.0)
Osomala	10	07(70.0)
Atani	06	02(33.3)
Onitsha	04	02(50.0)
Umueri	10	04(40.0)
Umunya	03	02(66.7)
Ifite-Dunu	08	03(37.5)
Enugu-Ukwu	04	01(25.0)
Nnewi	04	01(25.0)
Ekwulobia	05	02(40.0)
Nnobi	05	01(20.0)
Agulu	09	03(33.3)
χ^2	-	104.000
p–value	-	0.03*

** = significant*

The differences were statistically significant ($p<0.05$) using Chi-square (χ^2). The significant difference in the prevalence of infection by sex (community and hospital) done using Chi-square test of significance difference (Table 2) indicated that female 22(55.0 %) were more infected than males 16(41.0 %).

Table 2: Sex prevalence of malaria in children in Anambra State, Nigeria

Variables (sex)	Number examined (n)	Number positive (%)
	Communities	
Male	39	16(41.0)
Female	43	22(55.0)
χ^2		0.845
P- value		0.38^{ns}
	Hospitals	
Male	95	90(94.7)
Female	71	67(94.4)
χ^2		0.651
P- value		0.92^{ns}

ns = not significant

Table 3 showed the age group prevalence of malaria infection in children in Anambra State, Nigeria. In the communities, children between 5 – 9.9 years (48.9 %) were more infected followed by children between 10 – 14.9 years (44.9 %) and 0 – 4.9 years (42.3%) while in the hospitals, children aged 0 – 4.9 years and 5 – 9.9 years had 93 %, while 10 – 14.9 years had 100 % infection.

Table 3: Age related prevalence of malaria in children in Anambra State, Nigeria

Variables (Age – years)	Number examined (n)	Number positive (%)
	Communities	
0 – 4.9	26	11(42.3)
5 – 9.9	47	23(48.9)
10 – 14.9	09	04(44.4)
Total	82	38(46.3)
χ^2	-	0.310
P – value	-	0.856^{ns}
	Hospitals	
0 – 4.9	98	92(93.9)
5 – 9.9	44	41(93.2)
10 – 14.9	24	24(100)
Total	166	156(94.6)
χ^2	-	1.637
P – value	-	0.651^{ns}

ns = not significant

The monthly prevalence of malaria in Anambra State, Nigeria is summarized Table 4. The months of March, April, June, July, August, September, October and November had 100 % infection respectively followed by December (93 %), May (92 %), February (83 %) and January (73 %). The differences in the monthly infection were highly significant (p<0.05).

Table 4: Monthly and seasonality prevalence of malaria in children in Anambra State, Nigeria

Variables	Number examined (n)	Number positive (%)
Months		
April	10	100 (100)
May	14	3 (92.9)
June	13	13 (100)
July	13	13 (100)
August	16	13 (100)
September	19	19 (100)
October	15	15(100)
November	12	12 (100)
December	15	14 (93.3)
January	15	11 (73.3)
February	12	10 (83.3)
March	11	11 (100)
χ^2	-	21.699
P- value	-	0.027*
Seasonality		
Rainy	88	81 (92.0)
Dry	78	76 (97.6)
χ^2	-	2.34
P- value	-	0.13

** = significant difference (p<0.05)*

There was more infection in the rainy season (97.4 %) than in the dry season (92.0 %). Comparison of the prevalence of malaria infection in the communities and hospitals showed that hospital infection was significantly (p<0.05) higher (94.6 to 46.3 %) than community malaria infection (Table 5).

DISCUSSION

The high prevalence of malaria in the hospitals in Anambra State may attribute to increase awareness of mothers/caregivers of the dangers of malaria infection on children especially the under fives. This must have resulted in their increase visit of government hospitals for the treatment of their children's malaria infection. This result is in agreement with the report that in Nigeria, over 50 % of out patients' attendance, 40 % of hospital admissions and 30% of child mortality are due to malaria infection (Okafor and Amzat, 2007; Olasehinde *et al.* 2010).

Table 5: Comparison of the prevalence of community and hospital managed childhood malaria infection in Anambra State, Nigeria

Variables	Infection status		
	Uninfected (%)	Infected (%)	Total (%)
Hospital	9(5.4)	157(94.6)	166(100)
Community	44 (53.7)	38(46.3)	82(100)
Total	53(21.4)	195(78.6)	248(100)
P-value	-	-	0.00*

** = significant difference (p<0.05)*

In this study the overall prevalence of malaria based on hospital attendance of febrile children is 94.0 %, while in the communities it is 46.3 % which is very high showing the endemic nature of malaria in Anambra State, Nigeria. The high prevalence rate in the study area could result in childhood anaemia and other malaria related conditions such as cerebral malaria (Chessed *et al.,* 2013). This may be attributed to the climate which influences the development of the mosquitoes as well as the human behaviour. The high prevalence of asymptomatic infection in the communities suggests the development of some degree of immunity to malaria infection by the children (Greenwood, 1984; Nwaorgu and Orajaka, 2011). This could be attributed to immunity derived from persistent malaria attacks.

The prevalence of malaria infection in the communities varied and the differences were significant. Community prevalence of malaria infection showed that Awka had the highest infection. This may be as a result of the fact that the hospital serves as a Teaching hospital to Anambra State University an also the location of the hospital in the State capital. Also differences in the community prevalence may attributed to lack of use of preventive measures like ITNs and the geographical location of the community The community prevalence also showed that the river line towns had high prevalence of malaria infection. This is as a result of their closeness to the river Niger that has tributaries that serve as a breeding site for the mosquito vector of *Plasmodium* parasite. The percentage prevalence of malaria infection in the different communities was relatively low compared to 93.4% prevalence of malaria infection reported by Ilozumba and Uzozie (2009).

Gender related prevalence of malaria infection in the communities in Anambra State, Nigeria showed that female had a higher prevalence than the males but the difference was not significant. This result is in line with Nwaorgu and Orajaka (2011) who reported that malaria infection in Awka North Local Government Area of Anambra State was not gender biased. Furthermore, hospital childhood malaria was not selective for sex. This is in line with Sarki (2012) who reported no significant difference in the prevalence based on sex. Nigeria is an endemic country for malaria with all the year round transmission and the children in the hospitals actually came from the communities, hence the no significant differences in sex prevalence in both communities and hospitals.

The result of this study also showed that there was no significant difference in infection rate in relation to age in both community and hospital survey. This result contradicts the significant difference in prevalence of *Plasmodium* infection among the age groups and sex in Igbo-Eze South Local Government of Enugu State and Umuchieze / Uturu in Abia State, all in Nigeria (Ekpenyong and Eyo, 2008; Kalu *et al*., 2012). The children in the communities were equally disposed to *Plasmodium* infection, hence the insignificant differences in the prevalence, even though the children between the ages 0 – 4.9 years had the lowest prevalence which may be attributed to higher attention given to children under five years of age malaria infection such as adequate protection against mosquito bites through the use of insecticide treated bed nets.

The monthly prevalence of malaria infection is influenced by conditions suitable for malaria parasite transmission. The conditions that are suitable for both the development of *Plasmodium* and mosquitoes were defined as the coincidence of precipitation accumulation greater than 80 mm, mean temperature between 18^0 C and 32^0 C and relative humidity greater than 60 % (Ayanlade *et al.,* 2010). These climatic conditions were prevalent in Anambra State, thus the all year round high prevalence of malaria with significant variations in percentage prevalence. The months of April to November are suitable for malaria transmission in Anambra State, hence the presence of malaria infection in both wet and dry season (Ayanlade *et al.,* 2010; Iwuora, 2014).

People seek treatment for malaria from a wide range of providers ranging from patent drug sellers to hospitals. Childhood malaria infection treated at home is based on presumptive diagnosis by mothers/care givers. The comparison of malaria infection prevalence in the homes and hospitals in this study showed that the prevalence was significantly higher in the hospitals. This is in line with a study in Northern Nigeria were children of illiterates in sub-urban villages had the highest mean parasite density of 950 with 17.1 % prevalence rate for malaria infection (Chessed *et al*., 2013). The encouragement given to mothers/caregivers to report any febrile childhood illness to the nearest health centre must have contributed to wide difference between the hospital prevalence and community.

Conclusions: The result of this study calls for the proper management of childhood malaria in the homes and hospitals by training and retraining of health care workers and the mothers/care givers in the formal health care systems to ensure quick and accurate diagnosis of childhood malaria in Anambra State, Nigeria.

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