ORIGINAL ARTICLE

Burden of Severe Malaria in Children at General Sani Abatcha Specialist Hospital, Damaturu, North-Eastern Nigeria

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ABSTRACT

Background: Malaria still remains the leading cause of morbidity and mortality among children in Nigeria. The initial decrease in the global burden of uncomplicated malaria reported by World Health Organization in 2014 was lost; presently 80% of cases of Malaria reported in the world are in the sub-Saharan African region in which Nigeria is the most populous country. In the insurgency-infested north eastern Nigeria, effort at reduction of malaria cases has not only stagnated but the gains have been reversed. Objective: To determine the burden of severe malaria during the period of high transmission in a region infested by insurgency. Materials and Methods: We retrospectively reviewed all the records of children admitted with malaria into the paediatric wards of the specialist hospital in 2017, at the peak of malaria infestation. Rapid assessment kit was used to make the diagnosis of malaria. Children with packed cell volume of less 15% transfused with blood were recorded. Results: Of the 2,316 children admitted, severe malaria constituted 1832 (79.1%), of which 104 (5.7%) died. About a quarter (23.4%) of these children had blood transfusion. Conclusion: Malaria infestation was high especially in the latter half of the raining season; there is need to have a multi-pronged and coordinated strategy to halt this ugly trend and ensure qualitative blood transfusion services in the community during this peak period.

KEYWORDS: Severe Malaria, Rapid Assessment Kit, Insurgency, Scourge, Children.

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Introduction

Malaria infestation has remained a major public health problem in the country, despite the efforts made by the Federal Government of Nigeria[1-4]. Malaria remains the leading cause of morbidity in week 40 accounting for 51% of all the cases, followed by acute respiratory infection(9%), acute watery diarrhea (8%) and severe acute malnutrition (7%) in the Northeast region as of 2016 [5]. World health organization (WHO) has reported that the incidence of malaria has dropped by 18% globally from 2000 to 2016 and 24% of deaths due to malaria was recorded in Nigeria being the highest in the world[6, 7]. In spite of investment made to curb malaria, the WHO African region recorded the smallest decline in the incidence of malaria (20%) globally in 2017 while the Asian Region had the highest (48%)[7].

Uncomplicated malaria, if not recognized and

treated promptly, has the risk of becoming complicated or fatal; thus prompt diagnosis is very essential. In children, severe malaria may develop so rapidly that early treatment of the uncomplicated malaria may not be feasible, especially where health facilities are not located within 30 minutes trekking in the community[8,9]. There is delay in assessing treatment for uncomplicated malaria, beyond 48 hours from the onset, usually in the under-fives, thus increasing the fatality of complicated or severe malaria[9, 10]. It is also known that where the population has been displaced and health facilities destroyed due to nefarious activities of the insurgents, inevitable delay occurs[5]. Thus severe malaria may develop so rapidly in these displaced communities that children may not receive any treatment before their demise[8]. Therefore, uncomplicated malaria must be recognized and treated promptly, because of its tendency to become complicated, making prompt diagnosis and treatment very vital.

In the northeast region, due to Boko Haram Insurgency, communities have been displaced[5], several homes destroyed, thus the people have to do with make-shift houses in remote locations. There were more floods in the year 2017, leading to more breeding site for mosquitoes. The National Malaria Survey[1], reveals that not all children sleep under the long lasting insecticidal net (LLIN), in both stable and make-shift settlements in the north eastern region.

A surge of malaria cases in the Northeast region has been reported[1], likely as a consequence of natural disaster and insurgency with the attendant disruption in the implementation of malaria control strategies. It was noted that the burden of severe malaria has increased globally in 2017 compared to the previous year,[7] thus we sought to determine the burden of malaria among children admitted into the major hospital serving the affected communities in the heart of Yobe state.

Methodology

Study design

The study was a retrospective one over a four-month period (July – October 2017) which corresponds to the period of surge of malaria infestation in the area studied. The admission and discharge register of the wards was used to retrieve all the admitted cases of severe malaria, which were rapid diagnostic test (RDT) positive, and received treatment based on the National Guideline[3].

Study population

All children admitted into the wards presenting with features of severe malaria, were included into the study.

Inclusion and exclusion criteria.

All children with clinical features of severe malaria[3] who had positive RDT for *P. falciparum*, were recorded and treated with intravenous artesunate and were followed by a course of Artemisin – based combined chemotherapy (ACT), while those with acute bacterial meningitis were identified and excluded from the study; these patients were treated with antibiotics as appropriate.

Study Area.

The General Sani Abatcha Specialist hospital (GSASH) is secondary health facility in Damaturu, Yobe State, capital, in the North East region of Nigeria. In GSASH, the emergency paediatric ward has 28 bed space capacities, while the paediatric medical ward has 30 bed spaces. The health facility has medical officers that render health services to the teeming population and visiting consultants, from the University of Maiduguri Teaching Hospital. The facility is also supported by *Médecins Sans Frontières* (MSF-Spain).

Data Analysis

The Data was entered into SPSS version 20 and cleaned. Variables were expressed as frequencies and percentages, categorical variables were analysed with *Chi* square and p values of less than 0.05 were considered statistically significant. Z test for difference in proportions was also used to evaluate for trends in the parameters evaluated.

Ethical Clearance

Ethical clearance to conduct the study was obtained from the Ministry of Health and Human Services, Damaturu, Yobe State.

Results:

During the period of the study, 2316 children were admitted. Out of these 1832 children had severe form of malaria (1832 / 2316) giving the prevalence of 79.1%. There were 776 (42.36%) females and 1056 (57.64%) males and giving F: M ratio of 1:1.36. Table 1 shows distribution of severe malaria across the months the study was conducted showing a sustained increase in the absolute number of cases admitted into the wards. The sustained increase can also be seen in the proportion of malaria cases in relation to the total admissions during the period of surge of malaria infestation.

Table 1: Distribution of severe malaria by months and total admissions

Month	Cases of severe malaria (%)	Total admission (%)
July	118 (6.44)	280 (12.09)
August	324 (17.66)	448 (19.34)
September	686 (37.45)	773 (33.38)
October	704 (38.45)	815 (35.19)
Total	1,832 (100)	2,316 (100)

The result of this study revealed a high stable transmission rates of malaria among the two age groups with late peaks of 358 and 356 cases in under-fives and five years and above respectively. At the beginning of the study, there were proportionately more children under the age of five affected (57.6%) than those five years and above (43.4%); the proportion almost equalized by October at 50.9% and 49.1% respectively. The number of new cases in under-fives continued to rise throughout the period of high transmission but in those five years and above, a peak was attained by the third month and decline commenced thereafter. This change in trend in the different age groups of children was found to be statistically significant ($p = <0.0001$).

Table 2: Distribution of cases of severe malaria by months/age

Months	Age (%)		Total (%)	p value*
	< 5 yrs	≥5 yrs		
July	68 (3.71)	50 (2.73)	118 (6.44)	<0.0001
August	157 (8.57)	167 (9.61)	324 (17.66)	<0.0001
September	330 (18.01)	356 (19.43)	686 (37.45)	<0.0001
October	358 (19.54)	346 (18.89)	704 (38.45)	<0.0001
Total	913 (49.8)	919 (50.2)	1,832 (100)	

*Z test for difference in proportions

Male children have higher prevalence of malaria parasite infestation during the entire period of the study across all age groups and the difference is statistically significant (using the Z test for difference in proportions).

Table 3: Distribution of cases of severe malaria by sex

Months	Sex (%)		Total	p value*
	Male	Female		
July	80 (4.37)	38 (2.07)	118 (6.44)	<0.0001
August	212 (11.57)	112 (6.11)	324 (17.66)	<0.0001
September	407 (22.22)	279 (15.23)	686 (37.45)	<0.0001
October	357 (19.49)	347 (18.94)	704 (38.45)	<0.0001
Total	1,056 (57.6)	776 (42.4)	1,832 (100)	

* Z test for difference in proportions

Chi Square $\chi^2 = 0.213$

Although the total number of children that died of severe malaria has increased as the surge progresses, there is disproportionately higher number of deaths recorded in July (11) and August (26) respectively despite the fact only 442 (24.12%) of the children were managed during this period. The increase in the number of deaths of children noted from the beginning of the study with time, during the period of high transmission, has been found to be statistically significant (p = <0.0001).

Table 4: Distribution of the outcome of Malaria infestation during the period of high transmission

Months	Outcome (%)		Total	p value*
	Discharge	Died		
July	107 (5.84)	11 (0.60)	118 (6.44)	<0.0001
August	298 (16.27)	26 (1.42)	324 (17.68)	<0.0001
September	653 (35.64)	33 (1.80)	686 (37.45)	<0.0001
October	670 (36.57)	34 (1.86)	704 (38.43)	<0.0001
Total	1,728 (94.32)	104 (5.68)	1,832 (100)	

* Z test for difference in proportions

Review of the records revealed that blood was transfused in 401 children with severe malaria from August to October, 2017 corresponding to 23.4% (401 / 1714) cases during the period.

Discussion

Malaria still remains the leading cause of morbidity and mortality among children in Nigeria, despite the preventive measures taken by all the three tiers of government. It is rapidly fatal in younger children and in all situations where there is delay in diagnosis and treatment[8-10]. The prevalence and pattern of severe malaria in all categories of children outside the neonatal period is similar, characterized by explosive increase in the number of new cases seen in the rainy season in tropical settings, especially in its second half. This pattern has remained in our setting despite the measures set up by the government to reduce malaria burden[1, 2]. Of the 2,316 children admitted, severe malaria constituted 79.1% of all admissions during the period. This may be as a result of interplay of many factors such as having more breeding site with onset of rains, increased flooding in the communities, poor or absent drainage systems, displaced families due to the on-going insurgency, thus a lot more people are now living in camps, not their homes[1, 5].

Other factors include poor community sensitization as some areas are difficult to reach, leading to late presentation of cases[2]. Balogun *et al*[11] with the aid of microscopy in febrile children under the age of five reported a much higher prevalence of 98.7% during the wet months of the year in Maiduguri. The higher detection rates may be explained by the higher sensitivity of microscopy in making diagnosis of malaria compared to RDT used in this study. Fagbamigbe[12] in his review of performance of RDT showed that although there was a significant agreement in the outcomes of RDT and microscopy tests, the discriminatory accuracy of RDT was weak. He also noted that the predictive accuracy, especially the positive predictive value (PPV) of the RDT, was very low. These measures of accuracies differed more in younger children, in the presence of anaemia, and in those with recent experience of malaria infestation among other characteristics[12]. The highest level of parasitaemia among the under five children in Maiduguri studied by Balogun *et al*[11] were in the months of July to October corresponding to the period of high transmission rates found in this study but reported a peak in August in contrast to the month of September. The variation may be accounted for by the diagnostic modality used or possibly the difference in age brackets of the study participants. Samdi *et al*[13] in Maiduguri showed that asexual parasitaemia was highest during the months of July to October highlighting seasonal variation throughout the year, but in addition, they showed that the month of September recorded the highest parasite densities which probably corresponds to highest transmission rates in the year; that is similar to the findings in this study despite the difference in the diagnostic modality used in the two studies at different sites[13].

The activity of insurgents has several health facilities destroyed, health workers killed or displaced while others were forced to migrate to other states. Representatives of drug companies that form a critical network to sustain the drug supply chain have moved out of most of north-eastern states, private pharmaceutical shops were closed or destroyed even within the state capital following the worst and pivotal attack of December 1st 2014 to the heart of Damaturu, the state capital, when the insurgents attempted to take over the city; two young doctors were among those killed[14]. Government owned health facilities are fraught with ineffectiveness related to availability of drugs, inadequate manpower and other supportive care services, bad access roads and absence of stable electricity which probably stemmed out from poor budgetary allocation to health[15]. The situation calls for malaria elimination surveillance research and a development agenda to employ more tools and strategies for active and prompt detection of infestation and provide prompt treatment[8]. There's also need to develop capacity to assess trends and respond without delay, so that surveillance itself becomes an intervention[16]. As a sequel to this, specialist care has to be outsourced on interim basis and the services are often epileptic due to security concerns. The quality of ACT available in the patent medicine store, which the community have access to, is a matter of great concern due to substandard drugs provided by unlicensed distributors[2].The relative higher prevalence of malaria parasite infestation among male children seen during the entire period of the study across all age groups may be related to better parental attitude to care for girl child who may be seen to be the weak sex in the face of social strife and insurgency. [9, 16, 17]. The male child is usually adventurous; stays outdoors till night hours, the nature of clothing and other cultural attire of the male child in the area of study may predispose him to mosquito bites[9, 12, 17, 18]. It is also pertinent to note that more than three-quarter of cases occur during the second part of raining season suggesting that a well-timed, multi-pronged and coordinated

strategy and intervention may swiftly change this ugly trend[2]. Nuwamanya *et al*[19] and Ewinetu *et al*[20] have shown that effective use of LLIN has been associated with low parasitaemia especially in children and women in communities where awareness is high[19, 20]. In the study setting, the effective use of specific interventions such as LLIN, insecticides residual spray is characterized by misapplication that ranges from unavailability of the net to improper use characterized by washing of the net and drying it up in the sun[4,5]. The streets in the locality have shallow, open and discontinuous drainage systems that are infrequently dredged. There's therefore the need to take definitive measures to reduce and interrupt breeding site of mosquitoes, promote widespread use of LLIN, improved awareness and community participation in the provision of care to curb the surge in malaria during these specific months[1, 2, 5, 19]. The National Guideline[3] provides that severe anaemia, as a complication of severe malaria, be treated through blood transfusion. Available records showed that there is relatively high demand for blood transfusion as 23.4% of the patients studied required it. Higher frequencies of blood transfusion were reported by other researchers in eastern Nigeria which may be attributed to longer duration of the rainy season[21]. Most children 6 months to 14 years with malaria may require blood transfusion[21]. Effort should be expended towards specific measures to promote primary prevention of malaria in children, as this will not only reduce morbidity and mortality of malaria, but will reduce the economic burden of the disease among semi-rural and rural dwellers in sub-Saharan Africa. In addition, other factors are likely contributory to the high prevalence of anaemia in these children that were not evaluated by this study[22]. There is a strong need to review the extant strategies employed in controlling malaria infestation especially among children under the age of five years. A community-based study that will evaluate all available health centres in the surrounding hinterland will best reflect the magnitude of the scourge. Due to security challenges, a large number of children may presently be in hard to reach areas and may lack access to treatment.

Conclusions

This paper highlights the scourge of malaria infestation and its consequent morbidity and mortality especially among children in an area affected by insurgency. It explores age and sex as the major determinants of disease severity in a community faced with inadequate health resources. It demonstrates the trends of malaria infestation during the period of high transmission. The paper further discusses the environmental and health system-related factors that need to be looked into, in order to effectively contain and reverse the new trend of increasing incidence of malaria with unacceptably high mortality rate.

Limitations of the study.

The quality and ready availability of blood screening and transfusion services in the hospital was not evaluated by this study, or the heightened risk of transmission of blood-borne infestations and infections such as Malaria and HIV, HBV and HCV respectively.

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