

# Prevalence and risk of malaria, anemia and malnutrition among children in IDPs camp in Edo State, Nigeria

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## ABSTRACT

**Background:** Malaria, anemia and malnutrition are global health challenges with significant morbidity and mortality, with higher rates among children particularly in Africa. Recently there has been displacement of over a million people due to different crisis in Nigeria. However, there is limited study on the public health issues facing these vulnerable populations. This study evaluated the prevalence and risk factors for malaria infection, anemia and malnutrition among children living in internally displaced persons (IDP) camp in Edo state, Nigeria.

**Method:** A total of 250 children up to 10 years old were included in the study in the year 2018. Malaria infection was confirmed by rapid diagnostic tests. The hematocrit level was obtained using a centrifuge microhaematocrit and converted to haemoglobin using standard conversion while nutritional status was determined from anthropometric measurements collected, and demographic characteristics were obtained by the use of questionnaire. Anemia and malnutrition were defined according to World Health Organization standards. The logistic regression analysis was used to determine associations between predictor variables and primary outcomes.

**Result:** Malaria infection and anemia were recorded for 55.2% and 54.0% of the children, respectively while malnutrition prevalence was 41.2% with wasting, underweight and stunting occurring in 0.04%, 11.2% and 39.2% respectively. Age was a significant risk factor for malaria with higher odds of having malaria infection in children 6–10 years of age [odds ratio (OR) = 2.032,  $P = 0.021$ ] than in younger children. Being 6–10 years (OR = 2.307,  $P = 0.015$ ) and having malaria infection (OR = 1.693,  $P = 0.048$ ) were identified as significant risk factors of anemia while being in the age group of up to 5 years was the only significant risk factor (OR for the older age group = 0.251,  $P \leq 0.001$ ) associated with malnutrition. Specific attention needs to be paid to children in IDP camps.

**Conclusion:** Anemia and malnutrition control should be integrated with existing malaria control and should include children above five years of age.

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## 1. Introduction

Internally displaced persons (IDPs) are persons who have been forced to leave their places of residence due to conflicts, violence or other natural or manmade disasters and who have not crossed a recognised state border. Globally there are over

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20 million IDPs with more than half in Sub-Saharan Africa (WHO, 2018). Since 2009, the Boko Haram insurgency has steadily become the single greatest cause of displacement in the northern parts of Nigeria, with >2.3 million people becoming refugees, internally displaced people (IDPs) or returnees as a result. In the last three years, the number of IDPs has more than doubled in Nigeria; from 868,000 to 1.7 million people making Nigeria host to the sixth largest IDP populations in the world (WHO, 2011; Crawley, 2004). More than 56% of the displaced are children (UNHCR). More than 63% of IDPs reside in host communities, sometimes in 'camp-like' conditions clustered around schools, and faith based organizations such as churches, mosques and mission homes. Population displacements always affect health systems. Of the forced migrants, IDPs are among the most vulnerable. Increased mortality among children under five and pregnant women has been recorded in IDPs. Malaria, HIV/AIDS and tuberculosis are common to any IDP scenario and difficult to control (WHO, 2018). Malaria has been shown to be endemic in >80% of areas affected by humanitarian emergencies (Crawley, 2004) and epidemics has been documented in IDP sites in Nigeria due to the high concentration of vulnerable populations. Due to lack of malaria prevention and control services, existing populations risk being affected by the presence of IDP sites through the emergence and transmission of infectious diseases and worsening environmental sanitation (WHO, 2019; CDC/WFP, 2005). A recent report by the World Health Organization states that, in 2017 all the highest burden African countries recorded increased malaria cases with Nigeria having additional 1.3 million cases from the previous year (Severin, 1999).

Malarial infections are often associated with some degree of anemia, the severity of which depends upon patient-specific and parasite-specific characteristics. Malarial anemia causes severe morbidity and mortality in vulnerable groups infected with *Plasmodium falciparum*. Severe anemia probably accounts for more than half of all childhood deaths from malaria in Africa, with case fatality rates in hospitals between 8% and 18% (Toole and Waldman, 1993).

The common outbreaks of communicable diseases in developing countries among vulnerable groups are linked to high levels of malnutrition (Ferreira et al., 2015). High incidences of severe malnutrition have been reported in refugee camps. Such levels of malnutrition raise serious concern because of the recognised synergism between poor nutrition and disease occurrence (Young and Jaspars, 1995).

According to a review by Ferreria et al., the relationship between malnutrition and malaria risk is complicated and measurement is impeded by the different metrics used for malnutrition. Ferreria et al., further present that malnutrition does not have a great impact on malaria prevalence and parasite density, except that in some epidemiological situations attributes of chronic malnutrition such as stunting, underweight and decreased increment on weight over time accompanied an increased risk of malaria or high parasitemia (Owoaje et al., 2016). In Nigeria, the humanitarian crisis in the North-eastern part of the country coupled with inter-communal clashes due to ethno-religious disputes as well as tensions between Fulani herdsmen and farmers have resulted in the displacement of more than a million people in the past eight years (Naij.com Media Limited [Internet], 2017). However, not much study has been conducted on the public health issues facing these vulnerable populations and there is limited report on the prevalence of infectious diseases and malnutrition in these populations in Nigeria.

This study aims at determining the prevalence of malaria, anemia and malnutrition infection as well as the risk factors of these public health issues among children in IDP camp in Benin, Nigeria.

## 2. Methods

### 2.1. Study site

The study site is an IDP camp located in a forest in Uhuogua, Ovia North East LGA of Edo State (6° 43' 11" N and 5° 57' 10" E) about 30km from the centre of Benin City. It is being managed by the International Christian Center (ICC). The ICC is a religious organization involved in Christian missionary and humanitarian activities in rural communities in different states in Nigeria. Majority of the IDPs are displaced people from the north-east region of Nigeria due to the insurgent activities of Boko Haram and ethno-religious conflicts (WHO, 2009a). The first batches of IDPs arrived in 2014 and since then, more displaced persons have been yearly admitted to the camp. Currently, the camp population is about 2000 persons including management staffs and IDPs with around 900 children made up mostly of Christians from Borno and Adamawa states. The camp has a clinic, and there is one health personal (a Nurse) that runs the clinic. There is availability of modern utility facilities within the camp and a good level of hygiene and sanitation conditions is maintained. Also, the ICC camp is secured with fence. The study was carried out among pre and school-age children of both sexes aged 3 months to 10 years old in the year 2018.

### 2.2. Design and setting of the study

The protocol for the study was approved by the ethical review committee of the University of Benin Teaching Hospital. Informed consent was also obtained from the IDP Camp coordinator. Verbal consent was obtained from the parent/caregivers after explaining the purpose, risks, and benefits of the study. Prior visits were made to the camp to obtain informed consent from the camp coordinator. Children 10 years old and below were asked to gather at the data collection venue. The camp coordinator and nurse ensured that all the children were gathered except those who were on quarantine due to chicken pox. Following a brief explanation of the purpose and procedure of the sampling, demographic characteristics and anthropometric measurements were taken and blood sample was collected for each child for haemoglobin concentration and malaria infection test. The sample size was calculated using 50% prevalence of malaria in children in the study area using the formula described

in a manual by Centres for Disease Control and Prevention/World Food Programme (CDC/WFP) in [International Nutritional Anemia Consultative Group \(1985\)](#). Demographic characteristics were obtained through the use of questionnaires.

### 2.3. Anthropometric measurements

Measurements such as height and weight were measured using a measuring tape and a weighing scale respectively. The WHO Anthroplus software was used to calculate Z scores for three malnutrition indices, height-for-age (HA), weight-for-age (WA), and weight-for-height (WH) (for children five months and below) ([WHO, 2007](#)). The mean and standard deviation (SD) of the Z scores were also computed. According to the WHO, a child was identified as having malnutrition if he or she scored  $< -2$  in one of the anthropometric indices of HA (stunting), WA (underweight) and WH (wasting) indices, while corresponding Z scores of  $< -3$  SD were considered indicative of severe malnutrition ([International Nutritional Anemia Consultative Group, 1985](#)).

### 2.4. Laboratory methods

The hematocrit (or packed cell volume) was obtained using a centrifuge microhaematocrit. About 0.5 mL of blood, equivalent to a drop, was extracted in a capillary tube, closed at one end and centrifuged ([Bain and Bates, 2001](#); [WHO, 2009b](#)). The hematocrit level was converted to haemoglobin using a standard conversion between the two measures ( $Hb = Ht/3$ ) which is commonly used to define cut-off points for estimating the prevalence of anemia ([Teh et al., 2018](#)). Participants were classified according to the status of anemia from haemoglobin concentrations, according to the cut-off point recommended by the World Health Organization (WHO) ([Charchuk et al., 2016](#)). Malarial anemia was defined as children with a malaria-positive smear for *P. falciparum* parasitaemia (of any density) and  $Hb < 11$  g/dL. Non-malarial anemia was defined as children with anemia and without a malaria-positive smear for *P. falciparum*. BIOCHECK rapid diagnostic test kit (sensitivity >99.0% and specificity 99.7% according to manufacturer) was used for detecting malaria infection in situ according to WHO guidelines ([Nkumama et al., 2017](#)).

### 2.5. Statistical analysis

Data were analysed using the IBM-Statistical Package for Social Sciences (IBM-SPSS) version 22. Means and standard deviation were used to summarize continuous variables while frequency and percentages were used for descriptive statistics. Pearson's Chi-Square ( $\chi^2$ ) was used to evaluate differences in proportions. Associations between predictor variables and primary outcomes were assessed using bivariate logistic regression analysis. Odd ratios (ORs) and 95% confidence intervals (CIs) were computed. Significant levels were measured at 95% CI with the level of significance set at  $P < 0.05$ .

## 3. Results

A total of 250 children with a mean (SD) age of 7.1(2.7) were evaluated. The number of females was slightly higher than males. Majority of the study population (70.0%) fall into the age category 6–10 years. The mean (SD) weight and height were

**Table 1**  
Socio-demographic and clinical characteristics of the study population.

Parameter	Total
Sex	Prevalence (n)
Female	62.4 (156)
Male	37.6 (94)
Parameter	Total
Clinical	Mean (SD)
Age in years	7.1 (2.7)
Weight in kg	20.9 (6.1)
Height in cm	110.4 (20.7)
Mean haemoglobin level(g/dL)	11.4
Parameter	Total
	Prevalence (n)
Malaria infection	55.2 (138)
Anemia	54.0 (135)
Malnutrition	41.2 (103)
Wasting <sup>a</sup>	0.04 (3)
Underweight	11.2 (28)
Stunting	39.2 (98)

<sup>a</sup> Wasting was evaluated for participants  $\leq 5$  years.

**Table 2**

Malaria infection prevalence with respect to sex and age.

Parameter	No examined	Prevalence (n)	P value
Age			
0–5	75	41.3(31)	
6–10	175	61.1(107)	0.004*
Sex			
Female	156	53.2(83)	0.414
Male	94	58.5(55)	

\* Statistically significant P value.

20.9(6.1) and 110.4(20.7) respectively while the mean of anemia was 11.4. Malaria infection, anemia and malnutrition were observed in 55.2%, 54.0% and 41.2% of the study population respectively “Table 1”.

The prevalence of malaria among the study population varied with age. Children of the 6–10 years group had a significantly higher ( $P = 0.004$ ) prevalence of malaria compared with the lower age group “Table 2”. Malaria infection prevalence was comparable between males (58.5%) and females (53.2%). A logistic regression model demonstrated age ( $P = 0.021$ ) as a significant predictor of malaria infection prevalence as shown in “Table 3”. Children 6–10 years old were 2.032 times more likely to have malaria than the 0–5 years group.

Overall 135 (54%) children had anemia. Of these 45(18%) and 90(36%) had mild and moderate anemia respectively. No severe anemia was recorded in the study. Differences by age were statistically significant with the 6–10 years group having more anemia than the 0–5 years group ( $P < 0.05$ ). The prevalence of anemia among the sexes was comparable and not statistically significant “Table 4”. Although the prevalence of moderate anemia was higher in both age groups and sexes, it was not significant.

The distribution of malaria positives by anemia severity is summarized in “Fig. 1”. Anemia prevalence was significantly higher among those children RDT positives ( $P = 0.05$ ).

In “Table 5”, the difference between the age groups as well as malaria status remained significant as risk factors of anemia from the logistic regression model. Children 6–10 years of age, and those malaria infection positive were 2 and 1.69 times, respectively more likely to be anaemic than their counterparts.

As shown in “Fig. 2”, the prevalence of malnutrition and stunting varied significantly within the age group ( $P < 0.001$ ) with the lower age group having higher prevalence. More males were malnourished (43.6%), underweight (18.1%) and stunted (42.6%) when compared with females (39.7%), (7.1%) and (37.2%) respectively though the difference was not significant in malnutrition and stunting. The difference in prevalence of underweight among the sexes was significant ( $P = 0.025$ ) with the males having a higher prevalence. Bivariate analysis revealed children of the 0–5 years age group ( $P < 0.001$ ) were significantly at odds of being malnourished “Table 6”.

#### 4. Discussion

This study examines malaria infection, anemia and malnutrition as public health challenges among children in IDP camp. The most common communicable diseases reported among children in IDPs is malaria with a prevalence of 84.8% (Owoaje et al., 2016) which is higher than that obtained in this study (55.2%). Similar observations have been made by Teh et al. (2018) in children <15 years living in different altitudes along the slope of Mount Cameroon. A lower prevalence of malaria was recorded by Charchuk et al. (2016) among children in an internally displaced camp in the Democratic Republic of Congo. The prevalence was however high compared to 7.5% prevalence in normal population. In a review by Owoaje et al. (2016), it was reported that the major physical health problems in IDP camps were fever/malaria (85% in children and 48% in adults) and malnutrition in children (stunting 52% and wasting 6%). Results from the study revealed the odds of having malaria were higher in the

**Table 3**

Risk factors influencing malaria infection prevalence.

Parameter	No examined	Prevalence (n)	Logistic regression			P value
			OR	95% CI		
				Lower	Upper	
Age						
0–5	75	41.3(31)				
6–10	175	61.1(107)	2.032	1.114	3.707	0.021*
Sex						
Female	156	53.2(83)				
Male	94	58.5(55)	1.170	0.681	2.010	0.569
Malnutrition	250	41.2(103)	3.899	0.402	37.827	0.241
Wasting	75	0.04(3)	0.256	0.012	5.489	0.384
Underweight	250	11.2(28)	0.996	0.384	2.582	0.993
Stunting	250	39.2(98)	0.235	0.025	2.199	0.204

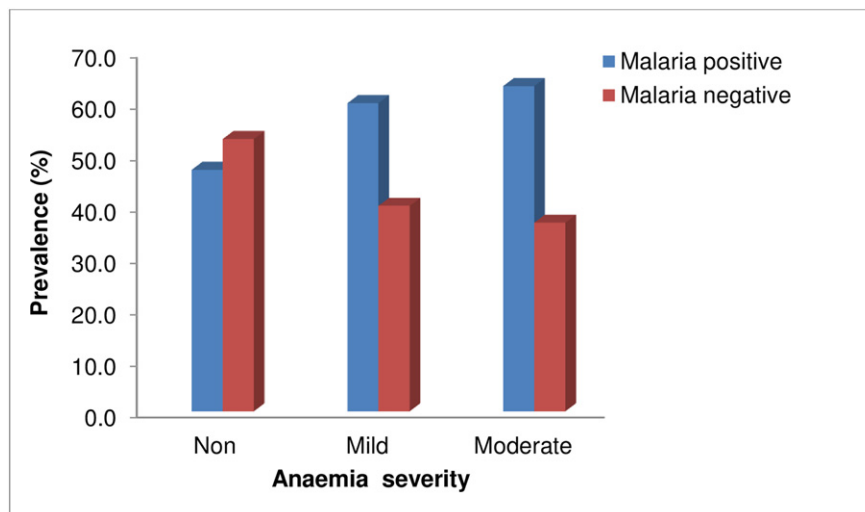
\* means significant values.

**Table 4**  
Anemia prevalence and severity in the study population.

Parameter	No examined	Prevalence (n)	P value	Anemia severity prevalence (n)			
				Mild	Moderate	Severe	P value
Age							
0–5	75	41.3(31)		17.3 (13)	24.0 (18)	0	
6–10	175	59.4(104)	0.018*	18.3 (32)	41.1 (72)	0	0.247
Sex							
Female	156	51.3(80)		17.9 (28)	33.3 (52)	0	
Male	94	58.5(55)	0.476	18.1 (17)	40.4 (38)	0	0.620
Malnutrition							
Yes	103	50.5(52)		17.5 (18)	33.0 (34)	0	
No	147	56.4(83)	0.562	18.4 (27)	38.1 (56)	0	0.802
Stunting							
Yes	98	50.0(49)		18.4 (18)	31.6 (31)	0	
No	152	56.6(86)	0.478	17.8 (27)	38.8 (59)	0	0.527

6–10 years age group. This attests to a report by [Nkumama et al. \(2017\)](#) that children between the age of five years and teenage are being noted as having an increased risk of uncomplicated malaria in Africa higher than their younger counterparts aged below 5 years. The reduction in the malaria burden among the under fives can be attributed to a scale-up of combinations of control strategies such as long-lasting insecticide-treated nets (LLINs) or insecticide-treated nets (ITNs), indoor residual spraying (IRS) and intermittent preventive therapy for pregnant women. These control strategies previously focused on under-fives needs to be extended to older-age categories. Information obtained through focus group discussions and one on one interviews revealed that most family in the camp had bed nets given to them by donors who visited the camp. Majority of those interviewed stated that their children sleep under the nets. However, the state of the bed nets could not be ascertained. Those who reported no usage of bed nets had not arrived at the camp before the donations. Only two children reported with fever which was confirmed to be malaria. All those positive for malaria were treated with artemisinin based combination drugs for malaria. The high prevalence of malaria in the camp despite the availability of bed nets could be due to the fact that the children most of their time outdoors and only retire to their rooms to sleep at night. The camp is also located in a rural area and is surrounded by thick bushes.

The prevalence of anemia (54.0%) recorded in this study compares with the Nigeria Nutrition Data by the United States Agency for International Development (USAID) which reports the prevalence of anemia among children 6–59 months as 68% ([USAID, 2018](#)). Several reports from around the country reveal high prevalence of anemia ([Osazuwa and Ayo, 2010](#); [Anumudu et al., 2018](#); [Akinbo et al., 2009](#)). Anemia has been a public health challenge especially in regions endemic for malaria where the relationship between malaria infection and anemia is well proven. Infection with malaria causes anemia through haemolysis and increased splenic clearance of infected and uninfected red blood cells and cytokine-induced dyserythropoiesis ([Crawley, 2004](#)). A single or repeated episode of malaria can result in life-threatening anemia and, if not treated, death. More than half of all childhood deaths in Africa is probably due to severe untreated malaria. However, many other factors may be responsible for anemia apart from malaria which includes poor nutritional status, micronutrient deficiencies, intestinal helminthes infection, HIV infection, and hemoglobinopathies ([Crawley, 2004](#)). An association between malaria infection and anemia was observed in this

**Fig. 1.** Anemia severity in relation to malaria infection.

**Table 5**

Logistic regression model showing risk factors of anemia.

Parameter	No examined	Prevalence (n)	Logistic regression			P value
			OR	95% CI		
				Lower	Upper	
Age						
0–5	75	41.3(31)	2.037	1.146	3.619	0.015*
6–10	175	59.4(104)				
Sex						
Female	156	51.3(80)	1.241	0.727	2.118	0.429
Male	94	58.5(55)				
Malaria						
No	112	45.5(51)	1.693	1.005	2.852	0.048*
Yes	138	60.9(84)				

\* means significant values.

study. Children who were positive for malaria infection were 1.7 times more likely to have anemia, when compared with those who were negative. The higher prevalence of anemia in the 6–10 years group contrasts with other reports where the under-fives had higher anemia prevalence. This may be due to the fact that this age group had more malaria infections than their younger counterparts. The result, however, compares with [Anumudu et al. \(2018\)](#) who recorded a prevalence of 63% in children above 6 years.

There have been reports on malnutrition among under-five children in IDPs. In Africa, the spectrum includes stunting (38.6%), underweight (28.4%) and wasting (7.2%) ([Owoaje et al., 2016](#)). The same trend was observed in this study in which malnutrition was prevalent (41.2%) in the community with an overall prevalence of 39.2% for stunting, the most common form of malnutrition, 11.2% for underweight and 0.04% for wasting. The prevalence of stunting was higher than the 37.0% obtained by [Osazuwa and Ayo \(2010\)](#) in rural communities in Edo, 3.75% by [Jeremiah and Uko \(2007\)](#) in Port Harcourt, 23.7% in mountain slope of Cameroon by [Teh et al. \(2018\)](#). The prevalence of stunting was comparable to Nigeria Nutrition Data by USAID (37%) while the prevalence of wasting and underweight was lower compared to the data ([USAID, 2018](#)). The prevalence of malnutrition was highest in the 0–5 age group in this study. Stunting and underweight are more common than wasting in any region of the world, and the same pattern was observed in the results of this study. The high prevalence of stunting in this study area is indicative of long-term, cumulative effects of inadequate nutrition and poor health status. There was no correlation between malnutrition and anemia or malaria infection from the results. The lower stunting prevalence observed in older children could be due to growth recover from early stunting ([Lundeen et al., 2014](#)). It could also be due to the fact that older category of children were born before the displacements and possibly had better nutrition at infancy. Internal displacement has significant direct and indirect effects on public health and the general well-being of the affected populations. During displacements, many risk factors work together to promote the growth and spread of infectious diseases. Epidemics of infectious diseases are quite common in IDP camp settings

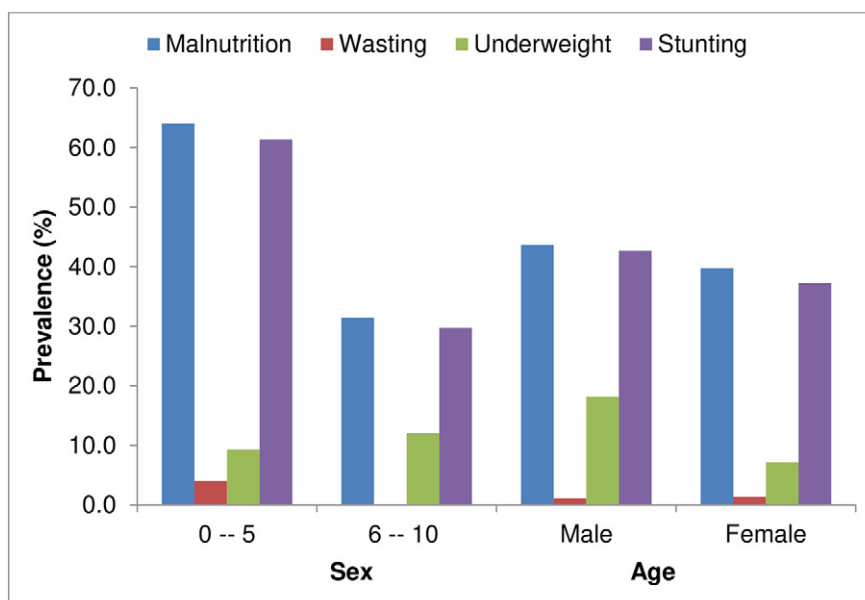


Fig. 2. Malnutrition in respect to age and sex.

**Table 6**  
Factors affecting the prevalence of malnutrition.

Parameter	No examined	Prevalence (n)	Logistic regression			
			OR	95% CI		P value
				Lower	Upper	
Age						
0–5	75	64.0(48)				
6–10	175	31.4(55)	0.251	0.139	0.454	0.000*
Sex						
Female	156	39.7(62)				
Male	94	43.6(41)	1.393	0.802	2.421	0.240
Malaria						
No	112	44.6(50)				
Yes	138	38.4(53)	0.968	0.561	1.672	0.908
Anemia						
No	115	49.5(51)				
Yes	135	38.5(52)	0.957	0.555	1.649	0.957

\* means significant values.

due to inadequate water and sanitation and hygiene facilities combined with overcrowding. The high prevalence rates of malaria, anemia and malnutrition reported in this work could be attributed to several factors such as poor environmental sanitation and hygiene, overcrowding, inadequate access to good water supply, inadequate feeding and poor healthcare services.

## 5. Conclusion

To the best of our knowledge, this is the first study showing the current health problems among IDPs in Nigeria describing the prevalence of malaria, anemia and malnutrition and their co-existence in children 10 years and below. The key observation is that there is a limited study on the health problems of this population in Nigeria. This research work however provides baseline data for further studies and implies an important advance on public health among IDPs.

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## Ethics approval

The protocol for the study was approved by the ethical review committee of the University of Benin Teaching Hospital. Informed consent was also obtained from the IDP Camp coordinator. Verbal consent was obtained from the parent/caregivers after explaining the purpose, risks, and benefits of the study.

## Availability of data and material

All data generated or analysed during this study are included in this published article.

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There was no funding for the research.

## Authors' contributions

AOG AND IMR designed the research concept and analysed the data. AOG wrote the manuscript and IMR proofread and corrected the manuscript. Both authors read and approved the manuscript.

## Declaration of competing interest

The authors declare that they have no competing interests.

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