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## Some economic and socio-cultural factors associated with cerebral malaria among under-fives in Benin City, Nigeria.

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**Abstract Introduction:** Risk factors associated with the occurrence of cerebral malaria in under fives are well documented. Outside these acknowledged factors of age, location, and nutrition, other socio-economic/cultural factors could contribute to the maze of factors determining the occurrence of the morbidity.

**Methods:** To unravel such factors a key informant interview was conducted among resident doctors in paediatrics at the University of Benin Teaching Hospital. Factors identified formed the basis of this cross-sectional, case control study involving 64 cases each of subjects and controls with uncomplicated malaria carried out at the Hospital. Such factors as delay in accessing competent intervention, prolonged use of anti-pyretics, material educational status, use of substandard medication and abdominal scarification as identified were evaluated in the two sets of patients. Others evaluated included mothers' occupation and health seeking behaviours.

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**Results:** Factors found to be significantly associated with occurrence of cerebral malaria were initial treatment in clinics ( $X^2 = 6.43$ ,  $p = 0.011$ ) presence of fresh abdominal scarification ( $X^2 = 4.30$ ,  $p=0.038$ ) late presentation ( $X^2 = 32.64$ ;  $p=0.000$ ) and non- use of mosquito nets ( $X^2 = 9.14$ ;  $p=0.002$ ).

**Conclusion/Recommendations:**

Initial treatment either in clinics or non orthodox facilities contributed significantly to the occurrence of cerebral malaria. The implication of these is that pre- teaching hospital treatments were inadequate in managing the child meant to develop cerebral malaria. Attention should therefore be directed at these areas alongside use of mosquito nets if the objective is to minimise the occurrence of cerebral malaria.

**Key words:** Cerebral malaria, Risk factors, Under fives, Economic factors & Socio-cultural factors.

### Introduction

Malaria has remained the leading cause of morbidity and mortality in children below the age of five years in sub-Saharan African where the disease is endemic. It is estimated that 300 deaths/second in children in sub-Saharan Africa is attributable to the disease. In susceptible populations, for instance, children under five years of age it may manifest as uncomplicated or severe malaria.<sup>1,2</sup>

Death from severe malaria in children is most often caused by severe forms of the disease including cerebral malaria. Cerebral malaria refers to the development of un-arousable coma which cannot be attributed to another pathological process in a patient with falciparum malaria.<sup>3,4</sup> It is associated with a particularly high mortality

rate which averaged 18.6% in a 1998 survey of studies on African children.<sup>5</sup> In Africa, between 17 and 50% of hospital admissions for severe malaria are attributed to cerebral malaria.<sup>5-7</sup> It accounts for 10 to 27% of paediatric admissions in Nigeria and the Gambia with case fatality rate of between 15 and 50% in treated (hospitalized) patients.<sup>4,5</sup>

Cerebral malaria could be seen as emanating from continued parasite multiplication in initially uncomplicated cases.<sup>3</sup> It is rational therefore to see it as consequences of late treatment or intervention. Previous research efforts on cerebral malaria had centred majorly on unravelling risk factors for death rather than unravelling factors responsible for its development in the first place. What factors determine who develops complicated or

uncomplicated malaria in children of the same age group, gender and socio-economic status? What are the risk factors for the development of cerebral malaria? Such risk factors could vary with locations.

This study was therefore conducted to identify the economic and socio-cultural risk factors for cerebral malaria in Under fives in Benin City.

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## Subjects and Methods

Study was carried out in Benin City the Capital of Edo State, Nigeria. It lies within the malaria belt. Benin City has public and privately owned hospitals prominent among which are St. Philomena Catholic Hospital, Central Hospital and University of Benin Teaching Hospital (UBTH).

The Teaching hospital is located in Egor Local Government Area (LGA) which is one of the three LGAs that make up Benin City. The Hospital provides services to the three LGAs as well as other LGAs in Edo State. Patients seen at the Children's Emergency Room (CHER) and Paediatric Out Patient (POP) are drawn from various socio-economic groups. This study was conducted at Children's Emergency Room (CHER) which offers a 24 hour emergency service to children. It has a capacity of 12 beds and adjoining laboratory, POP unit plus a medical records unit. Patients are commonly admitted from the POP unit. Those with mild illnesses are sent home from POP after evaluation and commencement of treatment

This study was carried out between June 2007 and May 2008 to cover both rainy and dry seasons. Children aged 6 months – 5 years with clinically proven cerebral malaria and their mothers admitted into CHER served as subjects. Controls were children aged 6 months – 5 years and their mothers seen at the POP for simple uncomplicated malaria. Patients were recruited consecutively until the desired numbers (64 each of subjects and controls. Minimum sample size was determined using the formula as described by Araoye<sup>8</sup> and adopting a prevalence of 4.2%<sup>9</sup>) were met.

Key informant interview conducted amongst 40 paediatric residents in the Department of Child Health of the University of Benin Teaching Hospital on economic and socio-cultural risk factors for cerebral malaria identified the following factors for the accompanying reasons.

- **Mothers' Occupational Status:** Poverty is widespread in study locale. This translates to poor housing, feeding and health seeking behaviours. Therefore more children from poor socio-economic background would live in mosquito infected environment, live in houses devoid of nets and unlikely to use orthodox health facilities early because they would ill-afford them.
- **Late Presentation in Orthodox Health Facilities:** Late presentation (for the purpose of this study this

implies presentation in a competent health facility beyond 48 hours of onset of illness) stems from a number of factors, including ignorance, poverty, and poor health seeking attitude of the indigenous population.<sup>10</sup>

- **Use of Substandard/Inappropriate Medications:** Quite often parents of the sick child embark on self medication or purchase drugs (commonly inappropriate) from pharmacy shops/medicine stores. Interventions are ineffective allowing the disease to smoulder on.
- **Prolonged use of Antipyretics:** Anecdotal observations suggest that sizeable a population believe that the treatment of every febrile illness is use of antipyretics. But sole use of antipyretics cause the disease to smoulder, paving way for development of dire consequences. (for the purpose of this study this entails the sole or predominant use of paracetamol beyond 48hour of onset of illness.
- **Abdominal Tattooing/Scarification:** This is a culturally based interventional measure entailing tattooing/scarification on the skin overlying the spleen and liver. At best practice has a diversionary effect.<sup>11</sup>
- **Inappropriate Health Seeking Behaviour:** Appropriateness in response demands that the sick child including that with malaria be taken to competent health facility within 24 hours where evidence based practices are the guiding principles in management. For the purpose of this study any child seen outside medical clinics or hospitals or beyond 24 hours of onset of illness is considered to have benefited from inappropriate health seeking behaviour.
- **Maternal Educational Status:** The health of the child is inextricably linked to the educational status and by extension the socio-economic status of the mother.

The Ethics and Research Committee, UBTH approved the study. Informed consent was gotten from each respondent.

An interviewer administered questionnaire was used in collecting data from the respondents. This was done within 24 hours of admission ( for those admitted) and during initial contact for those seen at the POP.

Data were entered into a master sheet (spread sheet) and analyzed using the Statistical Package for Social Sciences (SPSS) Windows 13.0 version. Thereafter, frequency tables, charts and contingency tables were drawn up. Chi square test ( with Yates correction for continuity where appropriate) was used in assessing the strength of association between non continuous variables. P value less than 0.05 were considered significant.

## Result

### *Age characteristics of study population and occurrence of cerebral malaria.*

The modal age bracket of the under fives was 1-10 months in children with uncomplicated malaria as against 21-30 months in those with cerebral malaria. Beyond 30 months the occurrence of cerebral malaria declined with increasing age. Mean (SD) age of children with uncomplicated malaria (21.33±19.37months) was comparable with that of children with cerebral malaria of 27.78±14.96 months.

Regarding the mothers, the mean ages in the two groups were comparable (30.40±5.60 years vs 30.45±4.50 years). The modal age bracket in the two groups was 26-30 years. (Table 1).

**Table 1:** Age characteristics of study population and occurrence of cerebral malaria.

Characteristic	Uncomplicated malaria n (%)	Cerebral malaria n (%)
Age bracket of under five (months)		
1 – 10	25(39.1)	6(9.4)
11 – 20	13(20.3)	13(20.3)
21 – 30	10(15.6)	25(39.1)
31 – 40	04(6.3)	10(15.6)
41 – 50	05(7.8)	06(9.4)
> 51	07(10.9)	04(6.3)

### *Mothers' social characteristics and occurrence of cerebral malaria.*

Table 2 contains the relationship between form of malaria and some social characteristics of the mothers. In either group mothers with secondary level of education predominated. Whereas 18 (28.1%) of the 64 mothers of children with uncomplicated malaria had tertiary education, corresponding figure among the mothers of children with cerebral was 9/64 or 14.1%. Unskilled mothers predominated in both groups; 43/64 or 67.2% vs 44/64 or 68.8%. Skilled mothers were however fewer among mothers with children presenting with cerebral malaria. Occurrence of malaria was uninfluenced by the tribe of the mother. Though cerebral malaria occurred more among children born to mothers of Bini extraction, there was no statistically significant relationship between tribe/ethnicity and occurrence of cerebral malaria. ( $X^2 = 5.24$  df = 3: p = 0.155). Comparison of Binis and non-Binis in terms of occurrence of cerebral malaria revealed no significant relationship. ( $X^2 = 0.13$ ; p = 0.755)

**Table 2:** Mothers' Social characteristics and occurrence of cerebral malaria.

Variable	Uncomplicated Malaria n=64	Cerebral Malaria N=64	X <sup>2</sup>	P-value
<i>Mother's educational status</i>				
Nil	0(0.00)	2(3.1)		
Primary	14(21.9)	22(34.4)		
Secondary	32(50.0)	31(48.4)	7.64	0.054*
Tertiary	18(28.1)	9(14.1)		
<i>Mothers Occupational status</i>				
Unskilled	43(67.2)	44(68.8)		
Semi-skilled	10(15.6)	13(20.3)	1.30	>0.52
Skilled	11(17.2)	7(10.9)		2
<i>Mothers' Tribe</i>				
Bini	37(57.8)	35(54.7)		
Ishan	12(18.8)	6(9.4)	5.24	0.155
Ibo	6(9.4)	5(7.8)		
Others	9(14.1)	18(28.1)		

Likelihood-ratio Chi Square, 0.0000001 added to zero cell to permit computation

### *Mothers' housing characteristics and occurrence of cerebral malaria.*

No significant association existed between form of residence and occurrence of cerebral malaria though more families of children with cerebral malaria lived in single room apartment (<sup>19</sup>/<sub>64</sub> or 29.7% vs <sup>14</sup>/<sub>64</sub> or 21.9%). In contradistinction the occurrence of cerebral malaria was significantly influenced by use of non- insecticide treated nets (NITN). Forty four of the 64 (68.8%) children with cerebral malaria as against 27 of the 64 (42.2%) with uncomplicated malaria did not use mosquito nets. ( $X^2 = 9.14$ ; p = 0.002). Sixty Eight percent of children with cerebral malaria did not use nets. (Table 3).

**Table 3:** Mothers' housing characteristics and occur-

Variable	Uncomplicated Malaria n=64	Cerebral Malaria N=64	X <sup>2</sup>	P-Value
<i>Type of residence</i>				
Single room	14(21.9)	19(29.7)		
Multiples of rooms	30(46.9)	26(40.6)		
Flats	19(29.7)	19(29.7)	*2.43	0.488
Duplex	01(1.6)	0(0.0)		
<i>Use of mosquito nets</i>				
Yes	37(57.8)	20(31.2)		
No	27(42.2)	44(68.8)	9.14	0.002

rence of cerebral malaria

\* Likelihood-ratio Chi Square, 0.0000001 added to zero cell to permit

### Mothers' health seeking behaviour and occurrence of cerebral malaria.

Contained in table 4 are the relationships between mothers' health seeking attitudes and occurrence of cerebral malaria in Under fives. Significantly more children on whom scarification had recently been made had cerebral malaria. ( $\frac{8}{64}$  or 12.5% vs one out of 64 or 1.6%) ( $X^2 = 4.30$ ,  $p = 0.038$ ). Analysis of pre-hospital treatment revealed that far more children with cerebral malaria were initially managed in clinics, maternity homes and by traditional healers. Prior treatment in clinics was significantly associated with occurrence of cerebral malaria. ( $X^2 = 6.43$ ,  $p = 0.011$ ). Conversely fewer children who eventually had cerebral malaria were treated in chemists/drug stores and churches. ( $X^2 = 12.61$ ,  $p = 0.000$ ). Place of pre-hospital management of under-fives was not influenced by mothers' educational status ( $X^2 = 7.05$   $df = 10$ ;  $p = 0.755$ ). Three (33.3%) of the nine mothers with tertiary education offered home treatment to their children while two (22.2%) utilised services available in drug stores. Three of the 31 with secondary education treated their children at home while 13 (41.9%) each utilised the services available in drug stores and clinics. Corresponding figures for those with primary education or less were 3/24 or 12.5%, 4/24 or 16.7% and 9/24 or 37.5% respectively.

**Table 4:** Mothers' health seeking behaviour and occurrence of cerebral malaria.

Characteristics	Uncomplicated Malaria	Cerebral malaria	X <sup>2</sup>	P-Value
<i>Scarification</i>				
Yes	01(1.6)	08(12.5)	4.30	0.038
No	63(98.4)	56(87.5)		
<i>Place of pre-hospital treatment</i>				
Clinic	12(18.8)	25(39.1)	6.43	0.011
Chemist/drug store	39(60.9)	19(29.7)	12.61	0.000
*Maternity home	0(0.0)	04(6.3)	2.323	0.128
Traditional healer	01(1.6)	07(10.9)	3.333	0.068
Church	12(18.8)	09(14.1)	0.513	0.474
<i>Prolonged use of paracetamol</i>				
Yes	50(51.0)	48(49.0)		
No	14(46.7)	16(53.3)	0.17	0.33
<i>Late Presentation in Hospital</i>				
Yes	14	46		
No	50	18	32.6	0.000

\*Pearson's Chi Square with Yates correction

### Pre-Teaching hospital use of drugs and occurrence of cerebral malaria.

Twenty four children in each group had drug combination of two or more drugs.

Use of antipyretic prior to management in UBTH was common in the two sets of patients 28/40 or 70% in those with uncomplicated malaria vs 27/40 or 67.5% in those with cerebral malaria, (Table 5). Antipyretic were the most commonly used drugs among the two sets of patients. Prolong use of paracetamol was prevalent in the two sets of patients, 50/64 or 78.1% vs 48/64 or 75.0%, (uncomplicated malaria versus cerebral malaria). ( $X^2 = 0.17$ ,  $p = 0.676$ ). Other drugs used included anti-malarials and antibiotics.

**Table5:** Pre-Teaching hospital use of drugs and occurrence of cerebral malaria.

Drug	Uncomplicated malaria (f)	Cerebral malaria (f) 0.00).	X <sup>2</sup>	p value
Antipyretic n=55	28(50.9)	27(49.1)	0.032	0.085
Anti-malarial n=13	08(61.5)	05(38.5)	0.771	0.380

f = frequency

### Late presentation and occurrence of cerebral malaria.

Forty six (71.9%) of the 64 children with cerebral malaria were presented late to the Teaching hospital as against 14/64 or 21.9% that had uncomplicated malaria. Therefore late presentation in the Teaching hospital occurred significantly more in children with cerebral malaria. ( $X^2 = 32.64$ ,  $p = 0.000$ ). (Table 4) Reasons for late presentation among children with cerebral malaria were lack of funds, 28/46 or 60.9%; misdiagnosis in a peripheral clinic, 6/46 or 13.0%; initial but unsatisfactory treatment in a peripheral clinic, 3/46 or 6.5%. The remaining 9/64 or 19.6% presented late due to miscellaneous reasons as distance from the hospital and watchful expectancy. Corresponding figures in those with uncomplicated malaria were 6/14 or 42.9%, 2/14 or 14.3% and 6/14 or 42.9%.

### Discussion

Mosquito nets particularly insecticide treated nets can help minimise the transmission of malaria.<sup>12</sup> It is observed that most of the respondents with cerebral malaria did not use mosquito netting. This trend may be due to ignorance on their part concerning the worth of this interventional measure and the facts that they could ill-afford the cost of these nets. The type of residence of respondents could also influence their use of mosquito nettings. Those who live in flats or detached bungalows are more likely to use mosquito nets since they are more likely to belong to higher socioeconomic classes and

thus better endowed to acquire such nets.<sup>13</sup>

Though not significant association was found to exist between the educational status of mothers of the under fives and the type of malaria their children had, as far fewer mothers with tertiary level of education had children who developed cerebral malaria. This may in fact be related to their family socio-economic status.<sup>10,12</sup> Besides, such mothers are more likely to exhibit desirable health seeking attitude courtesy of their education, for instance, seeking attention for an ill child from a competent source. Their education may also translate to quality housing that could reduce to the barest minimum the incidence of severe malaria as they are more likely to use nets including insecticide treated nets.

No association existed between mothers' occupation and the occurrence of cerebral malaria among the under fives. In the era of mass unemployment there is a disconnect between education and occupation as educated but employed individuals find solace in less attractive employments or acquire newer skills albeit semi skills in order to remain competitive in the labour market. Education rather than occupation may be a more relevant social indicator.

Form of housing did not significantly influence the occurrence of cerebral malaria. Between the two groups distribution of forms of housing was essentially similar. The predominant house type of respondents with either form of malaria was "multiples of rooms" because this is the most affordable type of housing found in the study location. Ongoing efforts at popularising the use of nets as part of the malaria control programme may have reduced the importance of housing type as a factor in the incidence of severe malaria. Families are admonished to use nets irrespective of their abode. Therefore it is the use of the nets rather than housing type that is relevant in the determination of who develops malaria or not.

Parents' health seeking behaviour can influence the progression of diseases. More children who had cerebral malaria were managed in maternity homes or by traditionalists. It is not difficult to decipher why such children would have sub standard treatment as the facilities patronised are ill equipped to manage malaria appropriately let alone severe forms. Fewer children managed in clinics/drug stores had cerebral malaria. This observation could lay credence to the need to access the nearest facilities where appropriate care could be gotten. In tandem with the current approach to early diagnosis and treatment, patients are expected to be granted access to anti-malarials as soon as possible and chemist/drug stores are the easiest of such access. Against prediction however, more children accessing clinics prior to being managed in UBTH had cerebral malaria. Reason for this is not readily apparent. However it is plausible that such children were taken to such facility when it became obvious to parents that the child was already deteriorating. The clinics therefore may have served only as conduit to tertiary care.

Use of inappropriate drugs is cited by key informants as a factor in the incidence of cerebral malaria. Emerging from the study is the confirmation of the assertion as very few children in either group of malaria had access to anti-malarials. This observation is in negation of the prescriptions of the Roll Back Malaria (RBM) programme that advocates early and prompt access for individuals with suspected malaria.<sup>11,14</sup> To what extent the RBM has taken root in the study locale is difficult to assess. Inappropriate drug use particularly those involving use of antipyretics could create a false impression of improvement when in fact the disease is made to develop into severe forms. Studies have shown that the use of antipyretics in malaria may delay parasite clearance time.<sup>15</sup> That as many as twenty in each case had combination of unrelated groups of drugs would also suggest poly pharmacy which should be discouraged.

Prolong use or isolated use of paracetamol beyond 48 hours was not significantly associated with the development of cerebral malaria as the drug was used evenly between the two groups. Paracetamol is readily available and affordable. This could explain why there was no association between mother's educational status and prior use of paracetamol as observed in the study.

Scarification marks and tattooing were commoner in those with cerebral malaria. This may be related to the cultural beliefs inherent in the study location where children who have fever or do convulse apparently or commonly from malaria are believed to have bad blood needing to be drained.<sup>11</sup> Scarification marks are made on the skin overlying the spleen (imagined to have been enlarged apparently in response to malaria).

Significantly more children with cerebral malaria were presented late to competent health facilities. Late presentation in competent health facility is an acknowledged risk factor for malaria associated severe anaemia – another form of severe malaria.<sup>10</sup> Benefiting late from competent intervention implies that the morbidity could get complicated over time.<sup>11,16</sup> A large proportion of those who presented late however did so for lack of funds. This may be because orthodox care is considered expensive and not easily affordable by many.<sup>10</sup>

Against prediction mother's educational status did not influence the place of pre-hospital management, this may be because place of pre-hospital management is influenced by other factors such as cultural beliefs, proximity and availability of funds.

It is therefore recommended that female education and female empowerment be emphasized as they could influence her in taking quick and appropriate decisions relating to the health of her children and avoid complications such as cerebral malaria.

Health education to parents emphasizing the need for children with suspected malaria to get early and adequate care from a competent health facility is emphasized.

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