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Factors Associated with Severe Malaria in Children Under Five Years of Age at Mbarara Regional Referral Hospital, Uganda

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ABSTRACT

Malaria continues to be a major public health problem. In 2013, about 198 million cases of malaria were reported globally with a percentage of 82% in the WHO African Region, 12% in South-East Asia region and 5% in the Eastern Mediterranean region, leading to 584,000 deaths worldwide, with 90% of the deaths occurring in African region, 7% in the South-East Asia region and 2% in East Mediterranean regions. Uganda has the sixth highest number of annual deaths from malaria in Africa, as well as some of the highest reported malaria transmission rates in the world. Malaria was one of the leading causes of ill health and deaths, with approximately 16 million cases and over 10,500 deaths reported in 2013. It remains one of the most important diseases in Uganda in terms of morbidity and mortality. This study was aimed at determining the factors associated with severe malaria in children less than five years admitted to Mbarara Regional Referral Hospital. Of the 73 participants sampled, all participated in the study (100% response rate), with most of the children lying within age range of 2-3 years (38.4%), (n=28) the least number were in the age group of 0-1years and >3-4years of age that is 6.8 %. 57.5% of the patients with severe malaria were of male sex. Severe malaria was found to be more in second born children (43.8%). The highest number of patients with severe malaria had two siblings (39.7%), (n=29), with 53.4% (n=39) of the patients having onset of illness within two days from admission. Despite the effort put by the government on prevention of malaria there was a gap on utilization of mosquito nets and seeking health care within 24hours of onset of illness. Therefore, the health teams in the district and health workers in the hospital should sensitize people how to mosquito net as major preventive measure against malaria.

Keywords: Malaria, Children, sub-Saharan Africa, Mosquito net, Health workers.

INTRODUCTION

Globally, malaria was responsible for an estimated 429,000 deaths in 2015, despite drastic reductions in mortality rates between 2010 and 2015 [1]. A significant proportion of these deaths occurred in sub-Saharan Africa, where most countries are classified as endemic for malaria. Uganda falls under this classification which affects approximately 90% of the country's population [2]. The Global Technical Strategy (GTS) milestone for malaria for 2020 includes a 40% reduction of malaria related deaths, which will require a greater focus on severe malaria case management. Severe malaria typically occurs due to delayed treatment of uncomplicated malaria and is defined by clinical or laboratory evidence of vital organ dysfunction [3]. Despite the fact that malaria is easily preventable, curable and treatable, it still remains a big health threat and a leading cause of morbidity and mortality to many communities world over most especially in Sub-Saharan Africa [4-6]. Although there has been advances in terms of new drugs and vaccines, eradication is still a way off and many health strategies now focus on malaria prevention and control [7-10]. Malaria is a serious disease that's caused by a parasite that is spread by a certain type of mosquito which feeds on humans. People who get malaria are typically very sick. If it's not treated promptly, malaria can lead to death. However, illness and death from malaria can usually be prevented [11-13]. The bulk of the malaria disease burden is concentrated in sub-Saharan Africa, and in this area nearly all malaria is caused by plasmodium falciparum. Efforts to reduce the burden of malaria have intensified recently through the use of effective tools for malaria like intermittent preventive treatment for pregnant mothers, distribution of long lasting insecticide treated nets to the communities, early diagnosis and treatment [14, 15]. In Uganda, malaria remains the biggest cause of death for

children under five and one of the most important threats to new born babies. These deaths occur primarily among the poorest people because they do not have access to the drugs and protective measures necessary for prevention or cure. In Uganda malaria remain the most important disease causing significant morbidity, mortality and negative socio-economic impact. Children under five are at high risk because of their low immunity against the disease. Hospital records suggest that malaria accounts for 30-50 percent of outpatient visits, 15-20 percent of admissions and 19-14 percent inpatient deaths [16]. The mortality due to severe malaria in under-fives usually exceeds 10% and increases with age. Several predictive factors for death in severe childhood malaria have been identified, among them, coma, convulsions, anemia, acidosis, respiratory distress, hypoglycemia, retinal changes, increased concentration of lactate in blood and cerebral spinal fluid and increased concentration of tumour necrosis factor [17-20]. Despite the interventions by the internal community and health service to ensure that all those at risk receive appropriate preventive measures, diagnostics and treatment, there are still a number of children under five who suffer the severe forms of malaria in Mbarara Regional Referral Hospital. This study was therefore designed to determine factors associated with severe malaria in children under five years who presented at Mbarara Regional Referral Hospital (MRRH).

METHODOLOGY

Study Design

A cross sectional study was conducted to determine association between socio-demographic factors, health system factors, household factors and severe malaria in children less than five years admitted on pediatric ward in MRRH. Structured questionnaires were used to collect data from care-givers of the patients. Caregivers of children with severe malaria were contacted while their children are on admission.

Area of Study

Mbarara Regional Referral Hospital is located in western Uganda, approximately 268 kilometers southwest of Kampala, Uganda. According to the 2014 census data, Mbarara Regional Referral Hospital serves a population of 521,231 in Mbarara district. With a bed capacity of 600 beds, the hospital serves Mbarara, Ntungamo, Bushenyi, Kiruhura, Ibanda Rubiriz, mitooma, Buhweju and Sheema districts. The coordinates of Mbarara Hospital are: 036'59.0"S, 3039'32.0"E. (Latitude: 0.616389; Longitude:30.658889). Mbarara Hospital is one of the thirteen Regional Referral Hospitals in Uganda and one of the 15 hospitals designated as internship hospitals.

Study population

Study population was children less than five years who are admitted on pediatric ward due to severe malaria during the study period.

Inclusion Criteria

- Being admitted on pediatric ward for severe malaria.
- Care givers who give consent to participate in the study.

Exclusion Criteria

Refusal to give informed consent.

Sample Size Determination

The sample size was determined using the Kish-Leslie [21] formula:

$n = z^2p\,(1-p) / E^2$; Where n = Estimated minimum sample size required P= Proportion of 5% prevalence of severe malaria in children less than five years.
Z=1.96 (for 95% Confidence Interval) e = Margin of error set at 5%

$$n = 1.96^2 \times \frac{0.05\,(1-0.05)}{0.05^2}$$

n = 73.

Sampling Procedure

Simple random sampling method was used to get respondents to avoid bias. Small pieces of papers were written on number from 1 to 10 and whoever picked an even number and consents was allowed to participate in the study.

Data Collection method

Care-givers of children with severe malaria were interviewed using structured questionnaires. Most of the questions were closed ended. Data on caregivers whose children have severe malaria as well as the children themselves was captured. The questionnaire provided exhaustive options of responses from which respondents selected from. The questionnaire was designed to collect information on caregivers and their children's demographic factors as well as other health system and other household factors. Care-givers with children confirmed to have severe malaria were interviewed on the day of admission or the next day after the condition of the child has stabilized.

Data Analysis

After complete data collection, the data was subsequently fed into SPSS version 16 for analysis.

Quality control measures

Selected Research Assistants were trained on the study protocol, questionnaire, informed consent process and other study procedures. Completed questionnaires were checked on daily basis for accuracy, consistency and completeness.

Ethical consideration

Ethical approval was obtained from KIU IREC and MRRH.

Study proposal was presented to department of Pediatrics in MRRH for review and approval.

Written informed consent was obtained from the participants. Participants were given an opportunity to ask any question about the study and the investigator responded. Participants were free to decline from participating or withdraw consent at any time during the study. Confidentiality of the participant's information was maintained where patients were not required to put any identification on the questionnaire. Permission was obtained from the administration of MRRH before starting the study.

RESULTS

Total number of participants (n) =73

Parameter	Frequency	Percentage / %
Age(years)		
0-1 years	5	6.8
>1-2 years	11	15.1
>2-3 years	28	38.4
>3-4 years	24	32.9
>4-5 years	5	6.8
Total	73	100
Sex		
Male	42	57.5
Female	31	42.5
Total	73	100
Child in school		
Yes	43	58.9
No	30	41.1
Total	73	100
Birth order		
First born	15	20.5
Second born	32	43.8
Third born	19	26.0
Fourth born	5	6.8
Seventh born	2	2.7
Total	73	100
Number siblings		
One	14	19.2
Two	29	39.7
Three	15	20.5
Four	12	16.4
Eight	2	2.7
None	1	1.4
Total	73	100
Onset of illness		
Two days ago	39	53.4
Three days ago	20	27.4
Three days above	14	19.2
Total	73	100
Child presented to the hospital within 24 hours		
Yes	21	28.8
No	52	71.2
Total	73	100
Reasons for not reporting to the hospital within 24hours of symptom onset		
Started medication at home	23	31.5

Didn't know it was malaria	15	20.5
Didn't know it was serious	4	5.5
Child given herbal medicine	8	11.0
Caregiver wasn't at home	3	4.1
Caregiver didn't have money	3	4.1
Brought within 24hours	17	23.3
Total	73	100
Symptoms Patient Presented With		
Presented with fever		
Yes	66	90.4
No	7	9.6
Total	73	100
Presented with irritability		
Yes	35	47.9
No	38	52.1
Total	73	100
Presented with reduced appetite		
Yes	52	71.2
No	21	28.8
Total	73	100
Presented with headache		
Yes	45	61.6
No	28	38.4
Total	73	100
Presented with abdominal pain		
Yes	33	45.2
No	40	54.8
Total	73	100
Presented with vomiting		
Yes	33	45.2
No	40	54.8
Total	73	100
Presented with diarrhea		
Yes	8	11.0
No	65	89.0
Total	73	100
	Investigations	
Investigation done		
Blood smear	21	28.8
Malaria rapid diagnostic test	19	26.0
Both RDT and B/S	33	45.2
Total	73	100
Results of investigation		

MRDT positive	25	34.2
B/S positive	18	24.7
Both positive	30	41.1
Total	73	100
Signs of Severe Malaria		
Prostration		
Yes	26	35.6
No	47	64.4
Total	73	100
Convulsions		
Yes	33	45.2
No	40	54.8
Total	73	100
Pallor		
Yes	43	58.9
No	30	41.1
Total	73	100
Loss of consciousness		
Yes	23	31.5
No	50	68.5
Total	73	100
Jaundice		
Yes	24	32.9
No	49	67.1
Total	73	100
Past history of admission for severe malaria		
Yes	24	32.9
No	49	67.1
Total	73	100
Period since last admission		
<A week	11	15.1
> A week	25	34.2
Never admitted	37	50.7
Total	73	100
Caregiver's Sociodemographic Factors		
Caregiver's sex		
Male	25	34.2

Female	48		65.8	
Total	73		100	
Caregiver's age				
15-19 years	6			8.2
20-29 years		41	56.2	
30-40 years	24		32.9	
Above 40 years	2		2.7	
Total	73		100	
Religion				
Catholic	40		54.8	
Protestant	23		31.5	
Islam	2		2.7	
7th day Adventist	8		11.0	
Total	73		100	
Tribe				
Banyankole	47		64.4	
Bakiga	18		24.7	
Bahima	1		1.4	
Batooro	3		4.1	
Baganda	4		5.5	
Total	73		100	
Level of education				
No formal education	14		19.2	
Incomplete primary education	15		20.5	
Complete primary education	9		12.3	
Incomplete secondary education	8		11.0	
Complete secondary education	13		17.8	
Certificate level	6		8.2	
Diploma level	8		11.0	
Total	73		100	
Occupation of the respondent				
Business	25		34.2	
Housewife	15		20.5	
Student	8		11.0	
Peasant	23		31.5	

Civil servant	2	2.7
Total	73	100
Means of transport to hospital		
Car	6	8.2
Motorbike	56	76.7
Bicycle	4	5.5
Foot	7	9.6
Total	73	100
Caregiver's relation to the patient		
Biological parent	71	97.3
Non-biological	2	2.7
Total	73	100
Caregiver marital status		
Married	55	75.3
Single	3	4.1
Divorced	4	5.5
Cohabit	11	15.1
Total	73	100
Health System Factors		
Child's community		
Village	65	89.0
Town	8	11.0
Total	73	100
Nearest health centre		
HCII	12	16.4
HCIII	37	50.7
HCIV	24	32.9
Total	73	100
Distance from the nearest health facility		
< 2 KM	7	9.6
2 - < 5 KM	36	49.3
5 - < 10 KM	13	17.8
10 - < 15 KM	7	9.6
> 15 KM	10	13.7
Total	73	100
Household Factors		
Type of house		
Permanent	39	53.4
Temporal	34	46.6
Total	73	100
The commonest source of lighting at night		

Electricity	24	32.9	
Solar	41	56.2	
Fuel lamp	8	11.0	
Total	73	100	
The commonest source of information			
Radio	52	71.2	
Telephone	16	21.9	
Television	5	6.8	
Total	73	100	
The commonest source of energy for cooking at home			
Firewood	53	72.6	
Charcoal	20	27.4	
Total	73	100	
Caregiver's Knowledge of Malaria			
Knowledge about malaria			
Yes	73	100.0	
How they got to know about malaria			
Radio	66	90.4	
At school	4	5.5	
Health worker	3	4.1	
Total	73	100	
Do they know the cause of malaria?			
Yes	66	90.4	
No	7	9.6	
Total	73		100
Cause of malaria			
Mosquito bite	63	86.3	
Cold food	4	5.5	
Eating raw mangoes	3	4.1	
Doesn't know	3	4.1	
Total	73	100	
Symptoms Of Severe Malaria			
Headache			
Yes	46	63.0	
No	27	37.0	
Total	73	100	
Fever			
Yes	61	83.6	
No	12	16.4	
Total	73	100	
Vomiting			
Yes	40	54.8	
No	33	45.2	
Total	73		100
Unconsciousness			
Yes	35	47.9	
No	38	52.1	
Total	73	100	
Prevention			
A child having a mosquito net			
Yes	50	68.5	
No	23	31.5	

Total	73	100
A child sleeps under a mosquito net		
Yes	43	58.9
No	21	28.8
Never	9	12.3
Total	73	100
Frequency of mosquito net use		
Regularly	17	23.3
Irregularly	38	52.1
Never	18	24.7
Total	73	100
Slashing bushes around the home		
Yes	51	69.9
No	22	30.1
Total	73	100
Draining stagnant water around the home		
Yes	30	41.1
No	43	58.9
Total	**73**	**100**

DISCUSSION

Socio-demographic factors of the child associated with severe malaria in children under five years.

Of the 73 participants sampled, all participated in the study (100% response rate), with most of the children lying within the age range of 2-3 years (38.4%), (n=28) the least number was in the age group of 0-1years and >3-4years of age that is 6.8 %. 57.5% of the patients with severe malaria were of male sex which was similar to the study conducted in rural and urban Molyko, Southwest Cameroon [22] and 58.9% were attending school. Severe malaria was found to be more in second-born children (43.8%). The highest number of patients with severe malaria had two siblings (39.7%), (n=29), with 53.4% (n=39) of the patients having onset of illness within two days from admission. The highest symptom patients presented with was fever (90.4%), which is similar to the report released by Health & Malaria [16], the second highest being reduced appetite (71.2%) and the least diarrhea (11.0%). The majority of patients presented with a sign of pallor accounting for 58.9%, followed by convulsions (45.2%), prostration (35.6%), and jaundice (32.9%) with the least being loss of consciousness (31.5%). Most of the patients that participated had no history of admission due to severe malaria (67.1%), however (32.9%), had a history of admission due to severe malaria. The majority of patients had never been admitted before (50.7%), those admitted more than a week ago were 34.2% and 15.1% being admitted less than a week from the current admission. Investigations done in the diagnosis of malaria were blood smear and malaria rapid diagnostic test however 45.2% of patients did both blood smear and malaria rapid diagnostic test, while 26.0% were tested with only malaria rapid diagnostic test and 28.8% were tested with only blood smear for malaria parasites. 41.1% of the patients had both blood smears and rapid diagnostic tests for malaria positive, 34.2% of the participants had only malaria rapid diagnostic test positive and 24.7% had only blood smears for malaria being positive. This was concurrent with the study conducted about the prevalence of malaria [23]. Majority (68.5%) of the caretakers reported that their children had a mosquito net while the remainder 31.5% of the children did not have a mosquito net. 58% of those with mosquito nets were sleeping under their nets while 28.8% were not using their nets. The majority (52.1%) of children who sleep under mosquito nets use the nets irregularly and 23.3% use the nets regularly. This was similar to the World Malaria Report [24].

Socio-demographic factors of the caregiver associated with severe malaria in children under five years

Most of the caregivers of the children admitted with severe malaria were of the female gender (65.8%), with the majority (56.2%) of the caretakers in the age range of 20-29 years. 54% of the caretakers were of catholic religion, 31.3% protestant, 11.0% Seventh-day Adventist and 2.7% Muslim. 75% of the caregivers were married, 4.1% were single 15.1% were cohabiting and 5.5% were divorced. Most caretakers were Banyankole by tribe (64.4%) this could be because the study was conducted in the Ankole region baganda being the least tribe among the caretakers.

The highest number of caretakers (20.5%) had not completed primary education, followed by those who

had never had any formal education (19.2%) and the lowest number was of those at certificate level. Most (34.2%) of the caretakers have business as their occupation followed by peasants (31.5%) and the least (2.0%) being civil servants. This is similar to a related study done by Sharma et al. [25] in India. The motorcycle was used by the majority (76.7%) of the participant to report to the hospital followed by footing (9.6%) and the least means of transport being the use of a bicycle (5.5%). 97.3% of the caretakers were biological parents to the child and 2.7% were not biological parents to the child. Most (71.2%) caretakers did not bring their children to the hospital within 24 hours from the onset of symptoms. The majority (31.5%) of the caretakers do not bring their children to hospital within 24 hours of onset of symptoms because they had started medication at home while the least number of caretakers (4.1%) didn't bring their children to hospital within 24hour from onset of symptoms because they did not have money and some were not present at home at time of onset of symptoms.100% of the caretaker had heard about malaria, majority (90.4%) of them reporting to heard about malaria from radio followed by 5.5% who got to about malaria from school and the least number (4.1%) of the caretakers reported to have known about malaria from a health worker. When assessed on knowledge of the cause of malaria 90% reported to know the cause while 9.6% did not know the cause of malaria. Of those who knew the cause of malaria, majority (86.3%) mentioned mosquito bite as the cause of malaria while 5.5% reported the cause of malaria to be eating cold food and the least number 4.1% reported eating raw mangoes to be the cause of malaria.

Household factors associated with severe malaria in children under five years

Most of children 89.0% were coming from village residence while a smaller number (11.0%) were from town residence. Majority (53.4%) were living in permanent houses while minority (46.6%) were living in temporal houses. The commonest source of light at night was solar which was 56.2% followed by electricity which was used by 32.9% of the participants, and the least was fuel lamps which was used by 11.0%. The majority (71.2%) of the caretakers reported using radio as their commonest source of information, followed by telephone use registered in 21.9% of the participants and the least number of 6.8% reported using television as the common source of information. The majority (72.6%) of the caretaker reported using firewood as a major source of energy for cooking and the remainder reported using charcoal as their major source for cooking.

Health system factors associated with severe malaria in children under five years

The highest number (50.7%) of the participants reported that their nearest health facility was at the level of Health Centre III (HCI) followed by Health Centre IV (HCIV) which was reported by 32.9% of the participants and the lowest number registered health centre II (HCII) which was 16.4%. Most (49.3%) of the research participants reported that they had to travel a distance of 2 - < 5 kilometres to reach the nearest health facility to access health services while an equal number (9.6%) of the participants had to travel a distance of 5 - < 10 kilometres or less than 2 kilometres to reach the nearest health facility which was the least registered percentage.

CONCLUSION

Among the factors associated with severe malaria, starting medication at home was the reason most caretakers gave as to why children had not reported to the hospital within 24 hours.

The majority of the patients had insecticide-treated mosquito nets, however they could not sleep under them regularly. The most common sex associated with severe malaria was males in the age range of 2-3 years. The majority of the caregivers knew about malaria and heard about malaria from the radio, knowing that the cause of malaria was a mosquito bite. The majority of the caregivers were females, in the age range of 20 – 29 years, Catholics by religion, banyankole by tribe, had incomplete primary education, business by occupation and used a motorcycle as a means of transport to the hospital. The most common symptom patients presented with was fever. The majority of the caregivers were married and biological parents to the children, staying in the village and the nearest health center being Health Center III (HCIII).

Recommendation

Based on the findings of the study, there should be interventions to address the delays in bringing patients to the hospital within 24 hours from the onset of illness. More emphasis should be put by health workers on encouraging caregivers to avoid self-medication because most of them are using the wrong drugs like herbs. Even though most communities receive insecticide-treated nets, some don't sleep under them and others don't have them, therefore health workers, district and political leaders should put a lot of effort into educating their community members on the benefit of having mosquito nets and sleeping under them.

REFERENCES

1. World Health Organization. World Malaria Report 2015. https://doi.org/ISBN 978 92 4 1564403.
2. Kungu, E., Inyangat, R., Ugwu, O.P.C., & Alum, E. U. Exploration of Medicinal Plants Used in the Management of Malaria in Uganda. Newport International Journal of Research in Medical Sciences. 2023; 4(1):101-108. https://nijournals.org/wp-content/uploads/2023/10/NIJRMS-41101-108-2023.docx.pdf
3. Republic of Uganda, Makerere University Development Data 1. 2020; 1–36.
4. Ekpono, E. U., Aja, P. M., Ibiam, U. A., Alum, E. U., & Ekpono, U. E. Ethanol Root-extract of *Sphenocentrum jollyanum* Restored Altered Haematological Markers in Plasmodium berghei-infected Mice. *Earth line Journal of Chemical Sciences*. 2019; *2*(2): 189-203. https://doi.org/10.34198/ejcs.2219.189203.
5. Egwu, C. O., Aloke, C., Chukwu, J., Agwu, A., Alum, E., Tsamesidis, I, et al. A world free of malaria: It is time for Africa to actively champion and take leadership of elimination and eradication strategies. Afr Health Sci. 2022; 22(4):627-640. doi: 10.4314/ahs.v22i4.68. PMID: 37092107; PMCID: PMC10117514.
6. Egwu, C. O., Aloke, C., Chukwu, J., Nwankwo, J. C., Irem, C., Nwagu, K. E., et al. Assessment of the Antimalarial Treatment Failure in Ebonyi State, Southeast Nigeria. J Xenobiot. 2023;13(1):16-26. doi: 10.3390/jox13010003. PMID: 36648839; PMCID: PMC9844335.
7. Onyeji, C. O., Igbinoba, S. I., Olayiwola, G., & Adehin, A. (2017). Insight into clinically effective herbal antimalarial products: Effects on drug metabolizing enzymes and p-glycoprotein. *African Journal of Pharmacy and Pharmacology*, *11*(48), 591-613.
8. Osirime, E., Adeyemi, O. I., Igbinoba, S. I., & Onyeji, C. O. (2020). Chemotherapeutic interaction of Vernonia amygdalina (Delile) leaf extract with Artesunate and Amodiaquine in murine malaria model. *J Pharm Res Int*, *32*(3), 15-24.
9. Obeagu, E. I., Alum, E. U., & Ugwu, O. P. C. Hepcidin's Antimalarial Arsenal: Safeguarding the Host. Newport International Journal of Public Health and Pharmacy. 2023; 4(2):1-8. https://doi.org/10.59298/NIJPP/2023/10.1.1100
10. Obeagu, E. I., Alum, E. U., & Ugwu, O. P. C. Hepcidin: The Gatekeeper of Iron in Malaria Resistance Newport International Journal of Research in Medical Sciences. 2023; 4(2):1-8. https://doi.org/10.59298/NIJRMS/2023/10.1.1400
11. Ugwu, O. P. C., Nwodo, O. F. C., Joshua, P. E., Odo, C. E., Ossai, E. C., & Aburbakar, B. Ameliorative effects of ethanol leaf extract of Moringa oleifera on the liver and kidney markers of malaria infected mice. *International Journal of Life Sciences Biotechnology and Pharma Research*. 2013; *2*(2), 43-52.
12. Ugwu, O. P., Nwodo, O. F., Joshua, P. E., Odo, C. E., Bawa, A., Ossai, E. C., & Adonu, C. C. Anti-malaria and hematological analyses of ethanol leaf extract of Moringa oleifera on malaria infected mice. *International Journal of Pharmacy and Biological Science*. 2013; *3*(1), 360-371.
13. Okamgba, O. C., Nwosu, D. C., Nwobodo, E. I., Agu, G. C., Ozims, S. J., Obeagu, E. I., & Ifeanyichukwu, M. O. Iron Status of Pregnant and Post-Partum Women with Malaria Parasitaemia in Aba Abia State, Nigeria. *Annals of Clinical and Laboratory Research*. 2017; *5*(4), 206
14. Okorie, H. M., Obeagu, E. I., Eze, E. N., & Jeremiah, Z. A. Assessment of coagulation parameters in malaria infected pregnant women in Imo state Nigeria. *International Journal of Current Research in Medical Sciences*. 2018; *4*(9), 41-49.
15. Okorie, H. M., Obeagu, E. I., Obarezi, H. C., & Anyiam, A. F. Assessment of some inflammatory cytokines in malaria infected pregnant women in Imo State Nigeria. *International Journal of Medical Science and Dental Research*. 2019; *2*(1), 25-36.
16. Uganda Ministry of Health. The Uganda Malaria Reduction Strategic Plan 2014-2020. 2014; 1–83.
17. von Seidlein, L., Olaosebikan, R., Hendriksen, I. C. E., Lee, S. J., Adedoyin, O. T., Agbenyega, T., & Dondorp, A. M. (2012). Predicting the Clinical Outcome of Severe Falciparum Malaria in African Children: Findings from a Large Randomized Trial. Clinical Infectious Diseases, *54*(8), 1080–1090. https://doi.org/10.1093/cid/cis034.
18. Ogomaka, I. A., & Obeagu, E. I. Methods of Breast Feeding as Determinants of Malaria Infections among Babies in IMO State, Nigeria. *Breast*. 2019; *2*(01), 17-24.
19. Obeagu, E. I., Bot, Y. S., Obeagu, G. U., Alum, E. U., & Ugwu, O. P. C. Anaemia and risk factors in lactating mothers: a concern in Africa. *International Journal of Innovative and Applied Research*. 2023c; 11(02): 15-17. Article DOI: 10.58538/IJIAR/2012 DOI URL: http://dx.doi.org/10.58538/IJIAR/2012.
20. Obeagu, E. I., Nimo, O. M., Bunu, U. M., Ugwu, O. P.C., & Alum, E.U. Anaemia in children under five years: African perspectives. *Int. J. Curr. Res. Biol. Med.* 2023; (1): 1-7. DOI:

http://dx.doi.org/10.22192/ijcrbm.2023.08.01.001.

21. Wiegand, H., & Kish, L. Survey Sampling. John Wiley & Sons, Inc., New York, London 1965, IX + 643 S., 31 Abb., 56 Tab., Preis 83 s. Biometrische Zeitschrift. 10, 88–89 (1968). https://doi.org/10.1002/bimj.19680100122
22. Kimbi, H. K., Nana, Y., Sumbele, I. N., Lum, J. K. A. E., & Tonga, C. Journal of Bacteriology and Parasitology Environmental Factors and Preventive Methods against Malaria Parasite Prevalence in Rural Bomaka and Urban Molyko, Southwest Cameroon. 2013; 4(1), 1–5. https://doi.org/10.4172/2155-9597.1000162.
23. Roberts, D., & Matthews, G. Risk factors of malaria in children under the age of five years old in Uganda. *Malar J* 15, 246 (2016). https://doi.org/10.1186/s12936-016-1290-x
24. WHO. World Malaria Report. 2018.
25. Sharma, R. K., Singh, M. P., Saha, K. B., Bharti, P. K., Jain, V., Singh, P. P., et al. Socio-economic & household risk factors of malaria in tribal areas of Madhya Pradesh, central India. Indian J Med Res. 2015; 141(5):567-75. doi: 10.4103/0971-5916.159515.

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