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Risk factors associated with severe malaria in children under five years of age at Jinja Regional Referral Hospital, Uganda.

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ABSTRACT

Malaria is among the world's most common and life-threatening tropical diseases. Malaria is caused by Plasmodium parasites, which are transmitted through the female Anopheles mosquito's bite, which occurs mainly between dusk and dawn. Children are mostly affected because their immune systems are not yet fully developed to fight severe forms of disease. This study determined risk factors associated with severe malaria in children under five years in the Jinja regional referral hospital in Jinja City, Eastern Uganda. A prospective cross-sectional study was conducted on 380 participants to determine factors associated with severe malaria among children under five years. After completing data collection, the data was subsequently fed into Statistical Package for the Social Sciences (SPSS) version 20 for analysis. In a tabular form, each independent variable was analyzed in a univariate form; the independent variables were compared with the dependent variable in a bivariate form, then subsequently multivariate, and this served as the basis for drawing conclusions in this study. Among the 380 participants in the study, the majority (57.6%) were above 3 years old, had household heads aged 26–40 years old (56.6%), and were male (65.3%). This study found that among the socio-demographic factors, age of the child, education level of the caregiver, and marital status of the caregiver were significantly associated with severe malaria among children under five years. Further, type of toilet facility used at home, size of household, having a treated mosquito net and using it, and number of children under five years in the household were significantly associated with severe malaria among children under five years. This study further established an association between distance to the health facility, waiting hours, getting all medication while at the facility, and severe malaria among children under five years. Severe malaria among children under five years old is still a big public health challenge. Factors associated with severe malaria among children under five years include age of the child, education level of caregiver, marital status of caregiver, type of toilet facility used at home, size of household, owning a treated mosquito net, number of children under five, distance to the health facility, waiting hours, and getting all medication while at the health facility.

Keywords: Risk, severe malaria, children, Jinja, regional, referral hospital, Uganda.

INTRODUCTION

The female Anopheles mosquito bite is the primary method of transmission for the common and potentially fatal tropical disease known as malaria[1, 2]. It affects about 3.4 billion people worldwide annually, with 1.2 billion at high risk. Although preventable and curable, malaria causes significant morbidity and mortality, especially in regions with limited resources. Sub-Saharan Africa is the most affected region, contributing over 80% of global malaria deaths [3–5]. Vulnerability is higher in certain groups, particularly pregnant women and children [6]. Children less than 5 years old represent 77% of all global malaria deaths, and their immune systems are not yet fully developed to fight severe forms of the disease. Severe malaria occurs due to delayed treatment of uncomplicated malaria, which is defined by the presence of clinical and laboratory evidence of vital organ dysfunction[7]. Efforts to reduce the burden of malaria have intensified recently through the use of effective tools like intermittent preventive treatment for pregnant mothers, the distribution of long-lasting insecticide-treated nets, and early diagnosis and treatment. Uganda has the third-highest number of P. falciparum infections in sub-Saharan Africa and some of the highest reported malaria transmission rates in the world. In 2015, malaria accounted for 34% of outpatient visits and 28% of hospital admissions. Hospital admissions decreased by two percentage points in 2015, while laboratory-confirmed cases increased by 16 percentage points [4].

Malaria, an ancient disease originating from the Italian word "mal-aria" or "bad air," has been the subject of numerous theories since its discovery in 1898 [8, 9]. The disease is primarily prevalent in tropical and subtropical regions, particularly in sub-Saharan Africa, but also in other tropical regions of China, India, Southeast Asia, and South and Central America. Malaria has been a widespread and potentially lethal human infectious disease, infesting every continent except Antarctica. Prevention and treatment have been targeted in science and medicine for hundreds of years. Research attention has focused on the biology of the parasites and the mosquitoes that transmit the parasites. Human behavior and living standards have been critical factors in the spread or eradication of the disease. Poverty has been and remains associated with the disease [10]. Traditional herbal remedies have been used to treat malaria for thousands of years, with the first effective treatment coming from the bark of the cinchona tree, which contains quinine. There are several theories proposed about malaria, including the themiasma theory, which suggests diseases were caused by the presence of miasma, a poisonous vapor filled with suspended particles of decaying matter characterized by its foul smell. This theory originated in the Middle Ages and endured for several centuries. In contrast to the long-held medical belief that malaria was a result of poor air quality, the mosquito malaria theory, which emerged in the latter half of the 19th century, proposed that mosquitoes were the primary vectors of the disease [11, 12]. Malaria is considered one of the main global health problems, causing approximately 438,000 deaths in 2015. Ninety percent of these deaths occur in sub-Saharan Africa, and 70% are of children under the age of five years old. However, malaria remains a major cause of morbidity in children in sub-Saharan Africa, with 10% of the deaths of children under the age of five due to malaria. Uganda ranks third in the total number of malaria cases in sub-Saharan Africa, and its weather conditions often allow transmission to occur all year round. Climates affect both the parasite and the mosquito, making it a complex and multifaceted issue [9]. Malaria is the leading cause of morbidity in Uganda, with 90% of the population at risk and 13% of underfive mortality. Children under the age of 5 are among the most vulnerable to malaria infection, as they have not developed any immunity to the disease. The malaria control program (MCP) was established in 1995 to guide the day-to-day implementation of the National Malaria Control Strategy [13]. Today, the fight against malaria is part of the overall effort of the government of Uganda, with the support of several partners, to improve health with the overall goal of reducing mortality due to malaria by 80% of the 2010 levels and morbidity due to malaria by 75% of the 2010 levels by 2020. Nationally representative cross-sectional surveys are carried out in the country to monitor and evaluate the progress of malaria control. The goal of the study is to identify risk factors, household and sociodemographic variables, and health-related variables linked to severe malaria in children under five years old at Jinja Regional Referral Hospital, Uganda. It also aims to investigate the relationship between these variables and the severity of the disease in these young patients.

METHODOLOGY

Study Design

A prospective cross-sectional study was conducted to determine the association between socio-demographic factors and household factors. Health system factors, and severe malaria in children less than five years of age admitted to the pediatric ward in Jinja regional referral hospital (JRRH). Structured questionnaires were used to collect data from the caretakers of the patients. Caregivers of children with severe malaria were contacted while their children were on admission.

Study Area

The study was conducted in Jinja Regional Referral Hospital (JRRH), which is located about 145km west of Malale, the largest city in the Eastern Region (2i). This is approximately 99km (135 mi) by road east of Kampala Uganda, the largest and capital city on all tarmac two-lane highway 3i. Jinja City is the main town of Busoga Kingdom in Jinja District. The district is bordered by Mayuge District to the east, Buikwe District to the northwest, Kamuli District to the east, Kayumga District to the southeast, Buvuma District to the southeast, and Lake Victoria to the north. JRRH is a public hospital funded by the Uganda Ministry of Health, and general care in the hospital is free. It is one of the 16 regional referral hospitals in Uganda, and it is designated as one of the 35 internship hospitals.

Study population

The study population was children less than five years old who were admitted to the pediatric ward due to severe malaria during the study period with their caregivers.

Inclusion Criteria

A child below 5 years old with a primary diagnosis of WHO-defined severe malaria was admitted to the pediatric ward of Jinja regional referral hospital. Caregiver who consented to participate in the study

Exclusion Criteria

A child admitted to the pediatric ward but for other disease conditions other than severe malaria
Caretakers who declined consent for participation in the study

Sample Size Determination

The sample size was determined using the Kish-Leslie [14] formula:

$n = z^2p\,(1\text{-}p) / E^2$;

Where;
n = Estimated minimum sample size required
P= Proportion of 55% prevalence of severe malaria in children less than five years.
Z=1.96 (for 95% Confidence Interval)
e = Margin of error set at 5%

$$n = 1.96^2 \times \frac{0.55(1-0.55)}{0.05^2}$$

n = 380

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 consented was enrolled into the study.

Data Collection method

This study involved interviewing caregivers of children with severe malaria using structured questionnaires. The questionnaires were open and closed-ended, collecting data on caregivers and their children's demographic factors, health system, and household factors. The interviews were conducted on the day of admission or the next day after the child's condition stabilized. The questionnaires were administered by trained research assistants, providing exhaustive options for responses. The study aimed to understand the impact of healthcare on caregivers and their children.

Data Analysis

After complete data collection, the data was subsequently fed into SPSS version 20 for analysis. In a tabular form each independent variable was analyzed in a univariate form, the independent variables was compared with the dependent variable in a bivariate form then subsequently multivariate and this served as the basis for making conclusionin this study.

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 (International Research and Development Conference) and JRRH. Study proposal was presented to department of Pediatrics in JRRH for review and approval. Written informed consent was obtained from the participants. Participants were given an opportunity to ask questions 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 by using unique reference codes during the data collection and analysis. Permission was obtained from the administration of Jinja regional referral Hospital before starting the study.

RESULTS

Socio-demographic characteristics

Among the 380 participants in the study, majority (57.6%) were above 3 years, had household heads aged 26-40years (56.6%) and were male (65.3%). Majority of the caregivers (67.1%) were farmers, 46.8% attained secondary education and were married (86.3%) as shown in the table below.

Table 1: Socio-demographic characteristics

Variable	Frequency(N=380)	Percentage (%)
Age of the child		
≤2years	161	42.4
≥3years	219	57.6
Age of the household head		
≤25years	97	25.5
26-40years	215	56.6
≥41years	68	17.9
Sex of the child		
Male	248	65.3
Female	132	34.7
Occupation of caregiver		
Farmer	255	67.1
Non-farmer	125	32.9
Educational level of the caregiver		
None	27	7.1
Primary	83	21.8
Secondary	178	46.8
Tertiary	92	24.2
Marital status of the caregiver		
Married	328	86.3
Single	52	13.7

Bivariate analysis of socio-demographic factors associated with severe malaria in children under five years.

At Bivariate analysis, age of the child, sex of the child, occupation of the caregiver, education level of caregiver and marital status of caregiver were significant with p-values less than 0.2 and were therefore considered for multivariate analysis as shown in the table below.

Table 2: Bivariate analysis of socio-demographic factors associated with severe malaria among children under five years

Variable	N=380	Severe malaria n (%)	cOR (95% CI)	P-Value
Age of the child				
≤2years	161	17(10.6)	1.50(0.84-3.60)	0.021
≥3years	219	14(6.4)	Reference	
Age of the household head				
≤25years	97	15(15.5)	2.41(1.00-4.82)	0.280
26-40years	215	07(3.3)	1.32(0.09-2.01)	0.312
≥41years	68	09(13.2)	Reference	
Sex of the child				
Male	248	22(8.9)	2.30(1.22-5.00)	0.019
Female	132	09(6.8)	Reference	
Occupation of caregiver				
Farmer	255	24(9.4)	3.04(1.99-6.78)	0.152
Non-farmer	125	07(5.6)	Reference	
Educational level of the caregiver				
None	27	09(33.3)	2.09(1.22-4.55)	0.038
Primary	83	12(14.5)	1.63(1.01-2.87)	0.410
Secondary	178	08(4.5)	1.17(0.72-2.10)	0.826
Tertiary	92	02(2.2)	Reference	
Marital status of the caregiver				
Married	328	18(5.5)	Reference	
Single	52	13(25.0)	1.00(0.08-2.40)	0.001

Multivariate analysis of socio-demographic factors associated with severe malaria in children under five.

From the table below, age of the child, education level of the caregiver and marital status of the caregiver were significantly associated with severe malaria among children under five years.

Table 3: Multivariate analysis of socio-demographic factors associated with severe malaria in children under five years

Variable	N=380	Severe malaria n(%)	aOR(95% CI)	P-Value
Age of the child				
≤2years	161	17(10.6)	1.02(0.51-2.45)	0.002
≥3years	219	14(6.4)	Reference	
Sex of the child				
Male	248	22(8.9)	1.10(0.82-3.37)	0.072
Female	132	09(6.8)	Reference	
Occupation of caregiver				
Farmer	255	24(9.4)	2.20(0.90-5.14)	0.065
Non-farmer	125	07(5.6)	Reference	
Educational level of the caregiver				
None	27	09(33.3)	1.65(0.98-3.73)	0.001
Primary	83	12(14.5)	0.81(0.55-2.01)	0.055
Secondary	178	08(4.5)	0.65(0.32-1.70)	0.482
Tertiary	92	02(2.2)	Reference	
Marital status of the caregiver				
Married	328	18(5.5)	Reference	
Single	52	13(25.0)	0.78(0.04-1.66)	0.011

Household characteristics

Table 4 below shows the household characteristics of the study participants. Majority (31.1%) had houses with walls made of sand and bricks,97.6% had houses roofed with iron sheets,61.6% didn't have electricity in their houses, majority (37.1%) use radio as a communication media and 85.8% use pit latrine. Majority (53.9%) had household size ≤5members, 83.9% had insecticide treated nets however only 62.1% use them. Most (61.3%) were from households with more than 2 children under five years and majority (74.2%) were from monogamous families.

Table 4: Household characteristics

Variable	Frequency(N=380)	Percentage (%)
What material was used to make the wall of your house?		
Wattle &mud	151	39.7
Wood	99	26.1
Sand and bricks	118	31.1
Plaster and tiles	12	3.2
What material makes up the roof of your house?		
Grass	09	2.4
Wood	-	
Iron sheets	371	97.6
Do you have electricity in your house?		
Yes	146	38.4
No	234	61.6
What communication media do you use at home?		
Television	85	22.4
Radio	141	37.1
Newspapers	120	31.6
Others	34	8.9
What toilet facility do you use at home?		
Flash toilet	43	11.3
Pit latrine	326	85.8
None	11	2.9
Size of the household?		
≤5 in number	205	53.9
≥6 in number	175	46.1
Do you have treated mosquito nets at home?		
Yes	319	83.9
No	61	16.1
If yes does the child sleep under a treated mosquito net?		
Yes	198	62.1
No	121	37.9
How many children are under five years in the household?		
1 child	147	38.7
2 and more	233	61.3
What is the type of family?		
Polygamous	98	25.8
Monogamous	282	74.2

Bivariate analysis of household factors associated with severe malaria among children under five years

Material used to make the wall of the house, material which makes up the roof of the house, toilet facility used at home, size of the household, having treated mosquito nets and using them, number of children under five years in the household and type of family were significant at bivariate analysis and were therefore considered for multivariate analysis as shown in the table below.

Table 5: Bivariate analysis of household factors associated with severe malaria among children under five years

Variable	(N=380)	Severe malaria in children under five n(%)	cOR(95% CI)	P-value
What material was used to make the wall of your house?				
Wattle &mud	151	14(9.3)	2.08(1.07-4.31)	0.193
Wood	99	09(9.1)	1.90(0.56-3.11)	0.024
Sand and bricks	118	07(5.9)	1.00(0.07-2.20)	0.302
Plaster and tiles	12	01(8.3)	Reference	
What material makes up the roof of your house?				
Grass	09	03(33.3)	1.09(0.78-4.73)	0.051
Wood	-	-	-	
Iron sheets	371	28(7.5)	Reference	
Do you have electricity in your house?				
Yes	146	10(6.8)	Reference	
No	234	21(4.0)	1.33(0.66-2.94)	0.316
What communication media do you use at home?				
Television	85	03(3.5)	Reference	
Radio	141	12(8.5)	0.72(0.21-1.67)	0.257
Newspapers	120	11(9.2)	1.27(0.55-2.18)	0.400
Others	34	05(14.7)	2.01(1.03-3.56)	0.328
What toilet facility do you use at home?				
Flash toilet	43	03(7.0)	Reference	
Pit latrine	326	24(7.4)	1.19(0.88-3.21)	0.045
None	11	04(36.4)	1.50(1.13-4.40)	0.003
Size of the household?				
≤5 in number	205	11(5.4)	Reference	
≥6 in number	175	20(11.4)	1.38(0.91-2.04)	0.120
Do you have treated mosquito nets?				
Yes	319	14(4.4)	Reference	
No	61	17(27.9)	2.21(1.17-4.15)	0.027
If yes does the child sleep under a treated mosquito net?				
Yes	198	09(4.5)	Reference	
No	121	22(18.2)	3.69(1.76-5.10)	0.001
How many children are under five years in the household?				
1 child	147	11(7.5)	Reference	
2 and more	233	20(8.6)	2.08(0.88-4.06)	0.144
What is the type of family?				
Polygamous	98	16(16.3)	1.44(0.92-3.49)	0.036
Monogamous	282	15(5.3)	Reference	

Multivariate analysis of household factors associated with severe malaria among children under five years

Type of toilet facility used at home, size of household, having a treated mosquito net and using it and number of children below five years in the household were significantly associated with severe malaria among children under five years as shown in the table below.

Table 6: Multivariate analysis of household factors associated with severe malaria among children under five years

Variable	(N=380)	Severe malaria in children under five n(%)	aOR(95% CI)	P-value
What material was used to make the wall of your house?				
Wattle &mud	151	14(9.3)	1.82(0.70-3.21)	0.054
Wood	99	09(9.1)	1.14(0.29-2.83)	0.070
Sand and bricks	118	07(5.9)	0.76(0.03-1.40)	0.634
Plaster and tiles	12	01(8.3)	Reference	
What material makes up the roof of your house?				
Grass	09	03(33.3)	0.79(0.38-5.12)	0.082
Wood	-	-	-	
Iron sheets	371	28(7.5)	Reference	
What toilet facility do you use at home?				
Flash toilet	43	03(7.0)	Reference	
Pit latrine	326	24(7.4)	0.84(0.51-2.20)	0.022
None	11	04(36.4)	1.10(0.93-3.62)	0.016
Size of the household?				
≤5 in number	205	11(5.4)	Reference	
≥6 in number	175	20(11.4)	0.63(0.44-1.54)	0.030
Do you have treated mosquito nets at home?				
Yes	319	14(4.4)	Reference	
No	61	17(27.9)	1.45(0.76-3.01)	0.006
If yes does the child sleep under a treated mosquito net?				
Yes	198	09(4.5)	Reference	
No	121	22(18.2)	2.42(1.00-4.04)	0.002
How many children are under five years in the household?				
1 child	147	11(7.5)	Reference	
2 and more	233	20(8.6)	1.17(0.51-3.47)	0.004
What is the type of family?				
Polygamous	98	16(16.3)	0.55(0.45-2.60)	0.089
Monogamous	282	15(5.3)	Reference	

Health system characteristics

Most (88.2%) of the participants were from communities with a health facility, residing a distance of 2-3km from the health facility (52.9%), used boda boda as a means of transport (51.6%), reported that they meet the health worker within 2 hours of arrival (57.6%) and report to get all their medication when at the health facility (70.8%) as shown below.

Table 7: Health system characteristics

Variable	Frequency(N)	Percentage (%)
Is there any health facility in the child's community?		
Yes	335	88.2
No	45	11.8
What is the distance of the health facility from home?		
≤1km	88	23.2
2-3km	201	52.9
≥4km	91	23.9
What means of transport do you use to go to hospital?		
Foot	137	36.1
Bicycle	31	8.2
Bodaboda	196	51.6
Motor care	16	4.2
How long does it take you to see the health worker when you reach the health facility?		
Within 1 hour	79	20.8
Within 2 hours	219	57.6
≥2hours	82	21.6
Do you get all medication when at health facility?		
Yes	269	70.8
No	111	29.2

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

Having health facility in the community, distance to the health facility, length of time taken to meet health a health worker while at the health facility and getting all medication when at the health facility were significant and considered for multivariate analysis as shown in table 5 below.

Table 8: Bivariate analysis of Health system factors associated with severe malaria in children under five years

Variable	N	Severe Malaria in children under five n(%)	cOR(95% CI)	P-value
Is there any health facility in the child's community?				
Yes	335	17(5.1)	Reference	
No	45	14(31.1)	1.15(0.60-3.04)	**0.156**
What is the distance of the health facility from home?				
≤1km	88	03(3.4)	Reference	
2-3km	201	16(8.0)	1.02(0.75-4.10)	**0.007**
≥4km	91	12(13.2)	2.33(1.23-6.41)	**0.018**
What means of transport do you use to go to hospital?				
Foot	137	18(13.2)	1.58(0.71-3.80)	**0.415**
Bicycle	31	03(9.7)	0.87(0.22-2.03)	**0.528**
Bodaboda	196	09(4.6)	0.42(0.03-1.67)	**0.311**
Motor care	16	01(6.3)	Reference	
How long does it take you to see the health worker when you reach the health facility?				
Within 1 hour	79	05(6.3)	Reference	
Within 2 hours	219	15(6.8)	1.83(0.76-4.99)	**0.024**
≥2hours	82	11(13.4)	2.00(1.27-5.60)	**0.004**
Do you get all medication when at health facility?				
Yes	269	19(7.1)	Reference	
No	111	12(10.8)	2.70(1.19-4.00)	**0.169**

Multivariate analysis of health system factors associated with severe malaria among children under five years.

According to the study, there was an observed association between distance to the health facility, waiting hours, getting all medication while at the health facility and severe malaria among children under five years as shown in table 9 below.

Table 9: Multivariate analysis of health system factors associated with severe malaria among children under five years

Variable	N	Severe Malaria in children under five n(%)	aOR(95% CI)	P-value
Is there any health facility in the child's community?				
Yes	335	17(5.1)	Reference	
No	45	14(31.1)	0.75(0.42-2.18)	0.061
What is the distance of the health facility from home?				
≤1km	88	03(3.4)	Reference	
2-3km	201	16(8.0)	0.83(0.55-3.60)	0.022
≥4km	91	12(13.2)	1.43(0.24-3.94)	0.036
How long does it take you to see the health worker when you reach the health facility?				
Within 1 hour	79	05(6.3)	Reference	
Within 2 hours	219	15(6.8)	0.91(0.08-3.00)	0.003
≥2hours	82	11(13.4)	1.70(0.65-3.72)	0.027
Do you get all medication when at health facility?				
Yes	269	19(7.1)	Reference	
No	111	12(10.8)	1.89(0.57-3.70)	0.042

DISCUSSION

Socio-demographic factors associated with severe malaria among children under five years

At multivariate analysis, age of the child, education level of the caregiver and marital status of the caregiver were significantly associated with severe malaria among children under five years.

This study established that children less than 2 years were more likely to develop severe malaria compared to older ones. Marcelline et al [13] and Griffin et al [15] found out that increasing age is protective against severe malaria. This may be due improved immunity with age as result of multiple exposures.

The current study found out that prevalence of severe malaria was inversely proportional to the education level of care takers. This is in agreement with a finding of a study in [16–18] which found that children whose mothers had higher education were less likely to develop severe malaria than those with mothers who had lower education. The level of education of caregivers influences their knowledge, attitudes, and practices related to malaria prevention. Educated caregivers are better able to comprehend and put preventative advice into practice. Caregivers with education also tend to come from affluent families. They reside in wholesome surroundings. These families have the resources to outfit their homes with mosquito-repelling elements like insecticide-treated mosquito nets, screens on windows and doors, and repellents.

Further, my study found out that children whose caretakers were single had higher odds of developing severe malaria compared to those whose caretakers were married. This may be due to less affordability of malaria preventive measures and prompt malaria treatment among single caregivers.

Household factors associated with severe malaria among children under five years

Type of toilet facility used at home, size of household, having a treated mosquito net and using it and number of children below five years in the household were significantly associated with severe malaria among children under five years.

This study revealed that the prevalence of severe malaria increased with a proportional increase in the size of the household. This is supported by the finding of a study in Rwanda [19]. The reason for this is that, if there are several people living together, one of could act as a reservoir for others.

Not owning an insecticide treated net was significantly associated with severe malaria. This study further indicates that use of an insecticide

treated net was a protective factor against severe malaria. This premise is consistent with a study which revealed that owning an insecticide treated net was a protective factor [20, 21]. .In Kenya and Nigeria, widespread ITN use has been shown to lower malaria morbidity and mortality [22], using a bed net protects from mosquito bites.

Children from households with more than two children under five years were more likely to suffer from severe malaria. Similar finding was reported by Tsegaye and colleagues [23].This implies that positive family support was hampered by social dynamics related to raising several children.

Material used to make the wall of the house, material used for roofing, having electricity in the house and type of family had no association with severe malaria. This is inconsistent with the findings of a study in Uganda [24].While a household's access to electricity may be related to that person's socioeconomic standing, it may also influence that person's way of life. For example, people who live in households without electricity may need to go outside more frequently, making them more likely to contract malaria from mosquito bites. Studies have shown that poor home conditions make it easier for mosquitoes to enter and spread malaria[25].

Health care factors associated with severe malaria among children under five years

According to the study, there was an observed association between distance to the health facility, waiting hours, getting all medication while at the health facility and severe malaria among children under five years.

Children travelling a distance of more than 4 km had higher odds of developing severe malaria. This is congruent with the findings of a study which revealed that long distance was significantly associated with severe malaria [26-30]. Travel time to a medical institution and related transportation costs may impact the decision to seek treatment for malaria as soon as possible, which could delay diagnosis and treatment if caregivers choose to begin treatment at home.

Long waiting hours and not getting all the medication when in the health facility were significantly associated with severe malaria [30–34].

CONCLUSION

Severe malaria among children under five years is still a big public health challenge. Factors associated with severe malaria among children under five years include age of the child, education level of caregiver, marital status of caregiver, type of toilet facility used at home, size of household, owning a treated mosquito net, number of children under-five, distance to the health facility, waiting hours and getting all medication while at the health facility.

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