

## Characteristics Linked to Severe Malaria in Under Five Years Old Children at Hoima Regional Referral Hospital, Hoima District

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### ABSTRACT

This research aimed to identify the factors associated with severe malaria in children below five years old at Hoima Regional Referral Hospital in Hoima District. The study employed a cross-sectional approach, gathering both qualitative and quantitative data via participant self-administered and investigator-administered questionnaires. A sample of 384 children, aged 6 months to 4 years, participated using convenience sampling. The findings, presented with 95% Confidence Intervals (C.I), Odds Ratios (OR), and P-values, were calculated using Binary Logistic Regression with Pearson's correlation in Statistical Package for Social Sciences (SPSS) Version 26. Visual representation utilized Microsoft Excel Software. The study had a response rate of 91.4%, encompassing 351 respondents, among whom 153 (43.6%) were male and 198 (56.4%) were female. The mean age was 2 years (with a standard deviation of 1.25 years). The malaria prevalence among these children attending HRRH was 27.4%. This prevalence was significantly linked to several factors: health service-seeking behavior, caretaker's education level, mosquito net usage, child's age, and caretaker's occupation, all exhibiting considerable influence on malaria in children under five. Pearson's correlation indicated the significance of these variables: health service-seeking behavior (0.139\*, P=0.021), mosquito net use (0.286\*, P=0.000), and health service-seeking behavior (0.131\*, P=0.021) with a 2-tailed test at a 95% confidence level, P<0.05. The high prevalence of malaria (27.4%) among children attending HRRH in Hoima District is notably affected by health service-seeking behavior, mosquito net usage, caretaker's education, caretaker's occupation, and the child's age.

**Keywords:** Malaria, children less than 5 years, Mosquito, Caretaker, Health service-seeking behaviour.

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### INTRODUCTION

Malaria was among the world's most common and life-threatening tropical diseases. Malaria was caused by Plasmodium parasites which are transmitted through the female Anopheles mosquito's bite which occurs mainly between dusk and dawn [1-3]. In humans, malaria is caused by 4 parasites namely; Plasmodium falciparum, Plasmodium vivax, Plasmodium malaria and Plasmodium ovale. P. falciparum and P. vivax are the commonest [4-6], however, P. falciparum remains the single most important threat to public health at a

global scale since it is the most deadly. It accounts for more than 90% of the world's malaria mortality, [7-9]. Malaria is endemic in most tropical regions and about 3.4 billion people worldwide are exposed to malaria annually and 1.2 billion are at high risk, [9, 10]. Although preventable and curable, malaria causes significant morbidity and mortality especially in regions with limited resources[11]. An estimated 300-500 million people suffer from malaria every year and 1.5-2.7 million deaths occur, [12]. Sub-Saharan Africa is the most

affected region contributing over 80% of global malaria deaths [6]. Although half of the world's population is at risk of malaria, and whilst anyone living or visiting a malaria endemic area may be at risk, vulnerability is higher in certain groups, particularly pregnant women and children. Malaria was a leading cause of death among children less than 5 years, who represent 77% of all global malaria deaths [7, 8, 13]. In Africa a child dies every minute from malaria [1]. Children are mostly affected because their immune systems are not yet fully developed to fight severe forms of disease. Severe malaria occurs due to delayed treatment of uncomplicated malaria. This stage of disease is defined by the presence of clinical and laboratory evidence of vital organ dysfunction. Almost all death from malaria result from infection with plasmodium falciparum[14] Malaria is easily preventable, curable and treatable , it's still a big health threat and a leading cause of morbidity and mortality to many communities world over most especially in Sub-Saharan Africa. 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 [15]. 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. 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 the communities, early diagnosis and treatment [16]. 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 the communities, early diagnosis and treatment [16]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. Malaria is a major public health concern in the world and more especially among the children because of their vulnerability .as such, malaria has been described as an entrenched global health challenge [17], the disease is endemic in over hundred countries in the world. Approximately half of the world's population is at risk of malaria and nearly one million people die of the disease each year [18]. In 2016, it was estimated that 216 million cases of malaria occurred worldwide and 445000 deaths occurred from malaria globally. The WHO African region had most cases that is 90% followed by the WHO south east ASIA region 7% and the WHO eastern Mediterranean region 2%, on the same note it was estimated that in 2016 most deaths 91% were in the WHO African region [14]. Two-thirds of malaria cases in 2016 were children under the age of five years and most of these deaths occurred in sub-Saharan Africa. Since 2010 mortality rates among children under 5 years have fallen by 34% [19]. Malaria is endemic in over 95% of Uganda (ministry of health 2014). Statistics from the Ministry of Health show that malaria is still the leading cause of death in Uganda, accounting for over 27% of deaths. The statistics also show that Uganda has the world's highest malaria incidence, with a rate of 478 cases per 1,000 Population per year. Uganda ranks 6th among African countries with high malaria-related mortality rates. In Uganda malaria remains 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[8] 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, acidosis, respiratory distress, hypoglycemia, retinal changes, increased concentration of lactate in blood and cerebral spinal fluid and increased concentration of tumour necrosis factor[20]. Many interventions have been made by the internal community the Ministry of Health and health services to ensure that all people at risk receive appropriate preventive

Emuron measures, diagnostics and treatment, there are still several children under five who suffer the severe forms of malaria most especially those in Hoima regional referral hospital. This study aimed to determine factors associated with severe malaria in children under the age of five at Hoima Regional Referral Hospital in Hoima District.

## METHODOLOGY

### Study Design

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

### Area of Study

The study was conducted in Hoima Regional Referral Hospital located in Hoima District. About 200 kilometres west of Kampala the capital city of Uganda, established in 1935. The hospital has a 300 bed capacity, with specialised departments which include maternity, medical wards, surgical wards, children's wards and causality. The hospital receives approximately 3million people per year. HRRH is a public hospital funded by the Uganda ministry of health and general care in the hospital is free. It is one of the 18 regional referral hospitals in Uganda and it is designated as one of the internship hospitals.

### Study population

The study population was children less than five yearsold who were admitted tothe pediatric ward due to severe malaria during the study period, their parents or caregivers and medical documents.

### Inclusion Criteria

A child below 5 years old with a primary diagnosis of WHO-defined severe malaria was admitted to the paediatric ward of Hoima Regional Referral Hospital. Caregivers who consented to participate in the study.

### Exclusion Criteria

Child admitted on paediatric ward but for other disease conditions other than severe malaria

Care takers who denied consent to participation in the study.

### Sample Size Determination

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

$n = z^2 p (1-p) / E^2$ ; Where n = Estimated minimum sample size required P= Proportion of 50% prevalence of severe malaria in children less than five years.

Z=1.96 (for 95% Confidence Interval) e = Margin of error set at 5%

$$n = 1.96^2 \times \frac{0.5(1 - 0.5)}{0.05^2}$$

$$n = 384$$

### Sampling Procedure

A simple random sampling method by convenience was used to get respondents.

### Data Collection Method

The study embraced the interviewing of the caretaker of the child with severe malaria. A well-prettested questionnaire was used with an interpretation of the local language (Runyoro and Luganda). The questionnaire was both self-administered and research assistant-guided.

### Data Analysis

After complete data collection, the data was subsequently fed into SPSS version 26 for analysis. Graphical Analysis was done by MS Excel.

### Quality control measures

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

### Ethical consideration

Ethical approval was obtained from KIU IREC and HRRH.

The study proposal will be presented to the Department of Pediatrics in HRRH for review and approval. Written informed consent will be obtained from the participants. Participants were allowed to ask any question about the study and the investigator will respond. 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 were obtained from the administration of Hoima regional referral Hospital before starting the study.

### Social-demographic characteristics of the study population

A total of 384 children from the age of 6 months to 4 years were studied with the response rate of 91.4%. Table 1 below shows the distribution of the study population by demographic

### RESULTS

characteristics. The results based on the 351 respondents showed that about 153(43.6%) of the children studied were male and 198(56.4%) were female. The mean age of study population was 2 years (with a standard deviation of 1.25 years).

**Table 1: Distribution of the Study Population by Demographic Characteristics at Hoima Regional Referral Hospital Hoima District, 2021.**

Characteristics	Frequency	Percentage (%)	95% Confidence Interval	
			Lower	Upper
<b>Sex</b>				
Male	153	43.6	38.6	49.2
Female	198	56.4	50.8	61.4
<b>Age</b>				
6-11 Months	62	17.7	13.5	22.2
1 Year	100	28.5	23.1	33.8
2 Years	68	19.4	15.0	23.5
3 Years	90	25.6	20.6	30.9
4 Years	31	8.8	5.5	12.0

### Social demographic characteristic of respondents

Table 2 shows Caretaker's characteristics where majority 249 (80.1%) were mothers, with the mean age of 31years (with a standard deviation of 12 years), of which 188 mothers were married, 52 were single mothers and 9 were widowed mothers.

Other care takers included fathers who were 5(1.6%), uncles who were 6(1.9%), aunties who were 32(10.2%) others 19(6.1%) who included grandmothers and other guardians who were not close parents to the children of the study population.

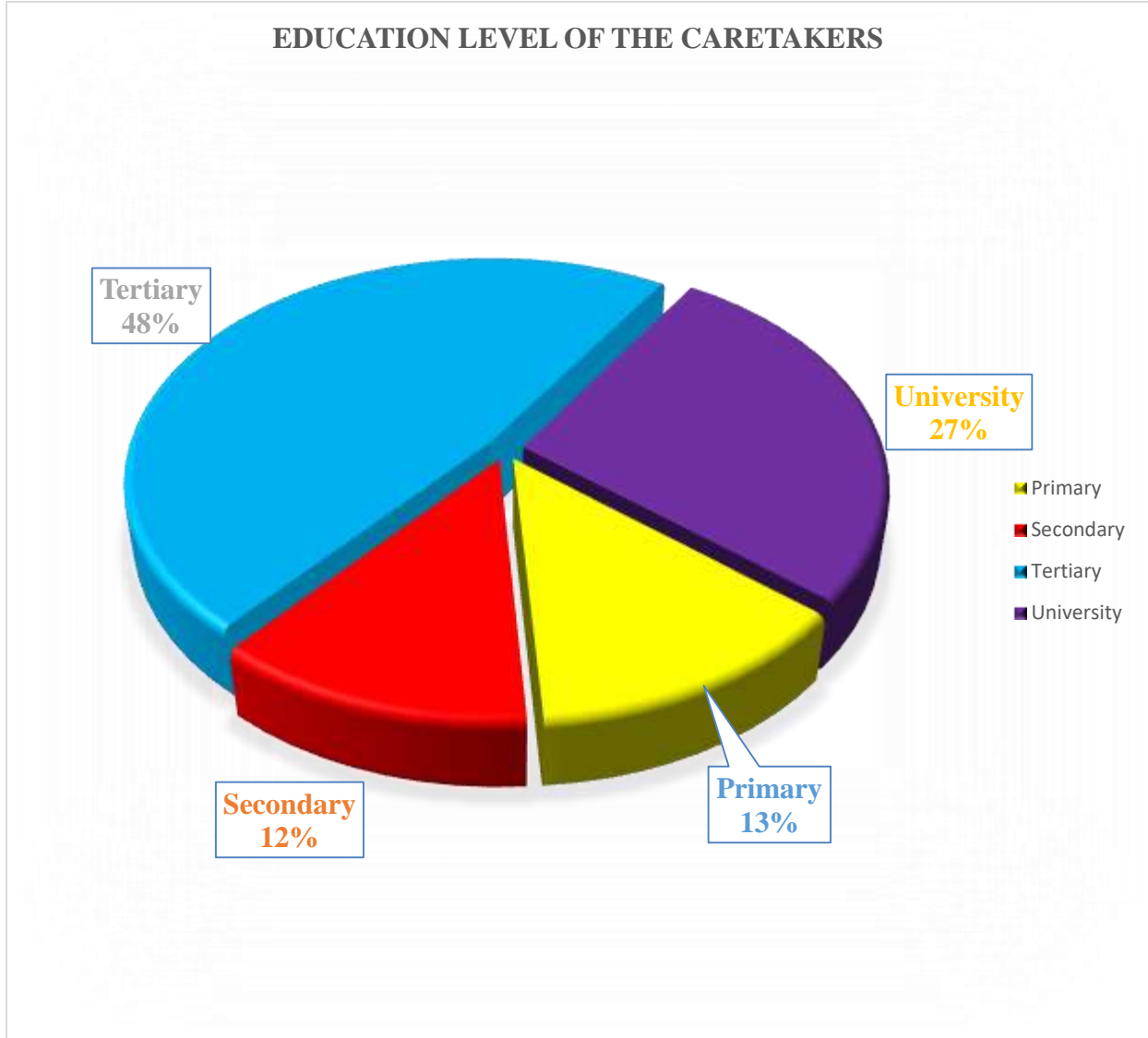
**Table 2: Distribution of respondents by their demographic characteristics at Hoima Regional Referral Hospital Hoima District, 2021.**

Characteristics	Frequency	Percentage (%)	95% Confidence Interval	
			Lower	Upper
<b>Caretaker's Relationship to Child</b>				
Mother	281	80.1	75.2	84.6
Father	6	1.7	0.3	3.2
Uncle	7	2.0	0.6	3.9
Auntie	36	10.3	7.3	13.8
Others	21	6.0	3.2	9.0
<b>Caretaker's Age Group</b>				
18-29	110	31.3	25.7	36.7
30-41	221	63.0	57.8	68.8
42-53	9	2.6	1.0	4.5
53-64	11	3.1	1.3	5.1

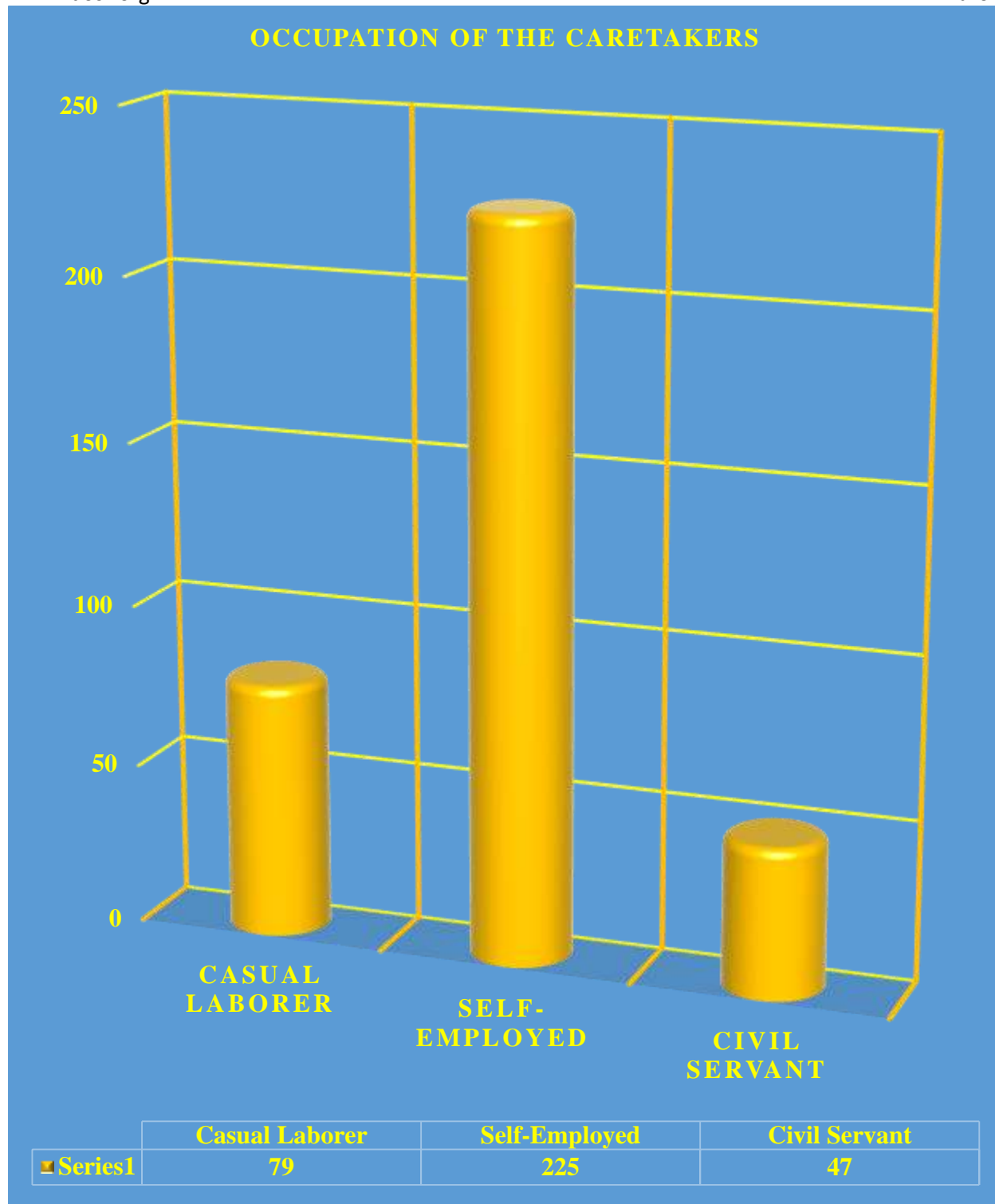
**Education level and Occupation of the caretakers**

The education level and occupation of the caretakers is represented below in **Figure 1** and **Figure 2** respectively showing that 45 caretakers attended primary school, 43

caretakers attended secondary school, 168 caretakers attended tertiary school and 95 caretakers attended university of which 79(22.5%) were casual laborers, 225(64.0%) were self-employed and 47(13.5%) being civil servants.



**Figure 1: Education Level of Caretakers.**

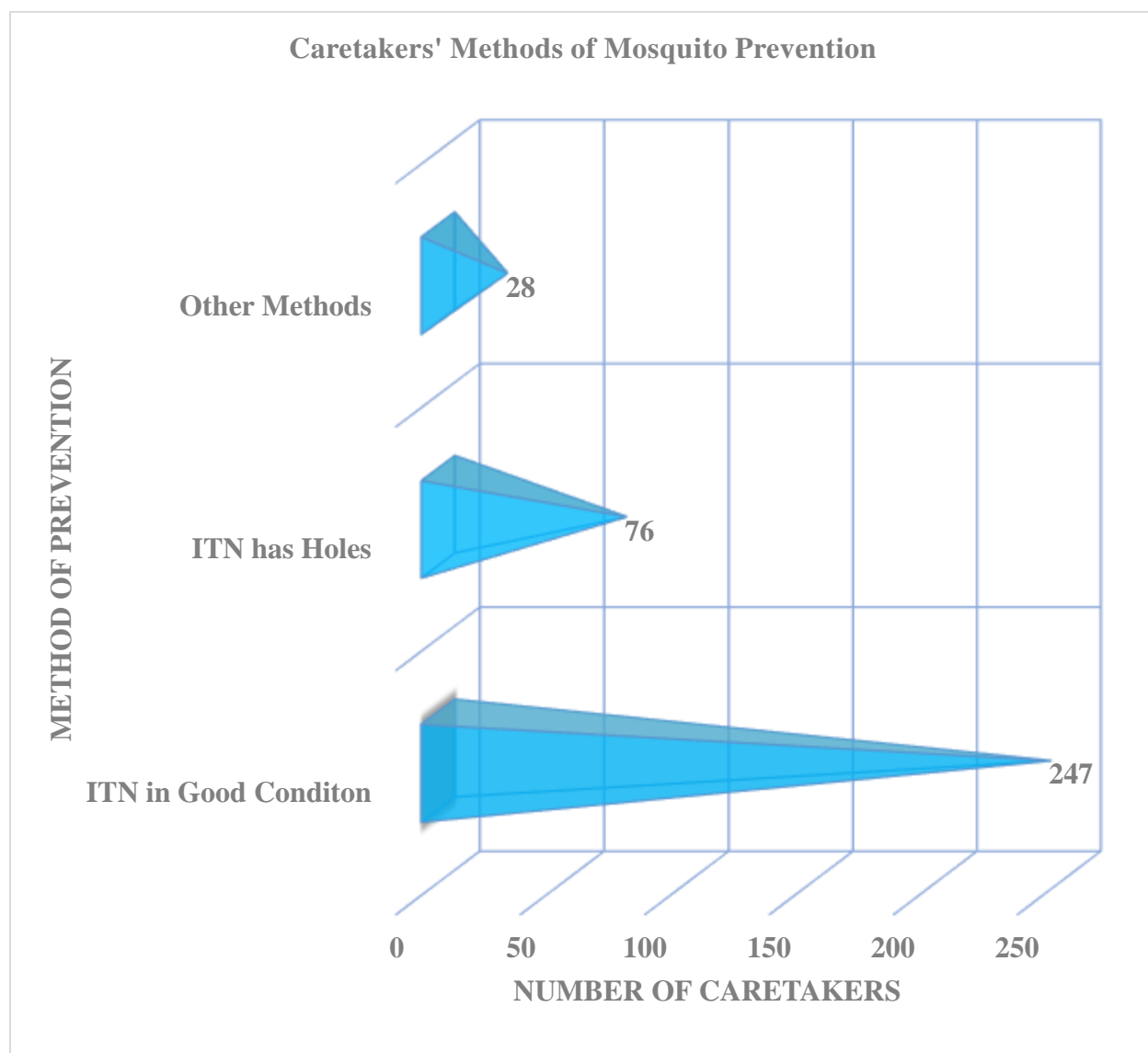


**Figure 2: Occupations of Caretakers.**

**Comparison of Preventive Measures Used by Caretakers against Mosquitos at Hoima Regional Referral Hospital Hoima District, 2021.**

Figure 3 shows the methods of mosquito prevention that caretakers use to protect their children from mosquito bites to their education level. It is clearly shown

in the figure that a total of 323 caretakers use Insecticide Treated Nets (ITNs), of which 247(70.4%) caretakers reported using ITNs in very good condition, 76(21.5%) caretakers reported that their mosquito nets were in bad condition and had holes, 28(8.0%) reported to be using other methods to prevent mosquito bites.



**Figure 3: Comparison of Preventive Measures Used by Caretakers against Mosquitos**

**Health Service Seeking Behavior of Caretakers for their Children.**

Table 3 shows the overall health service seeking behavior of the caretakers for their children regarding the treatment of

malaria. It is clearly shown that 334(95.2%) of the caretakers take their children to the health centre when they develop malaria whereas 17(4.8%) treat their children with local herbs at home.

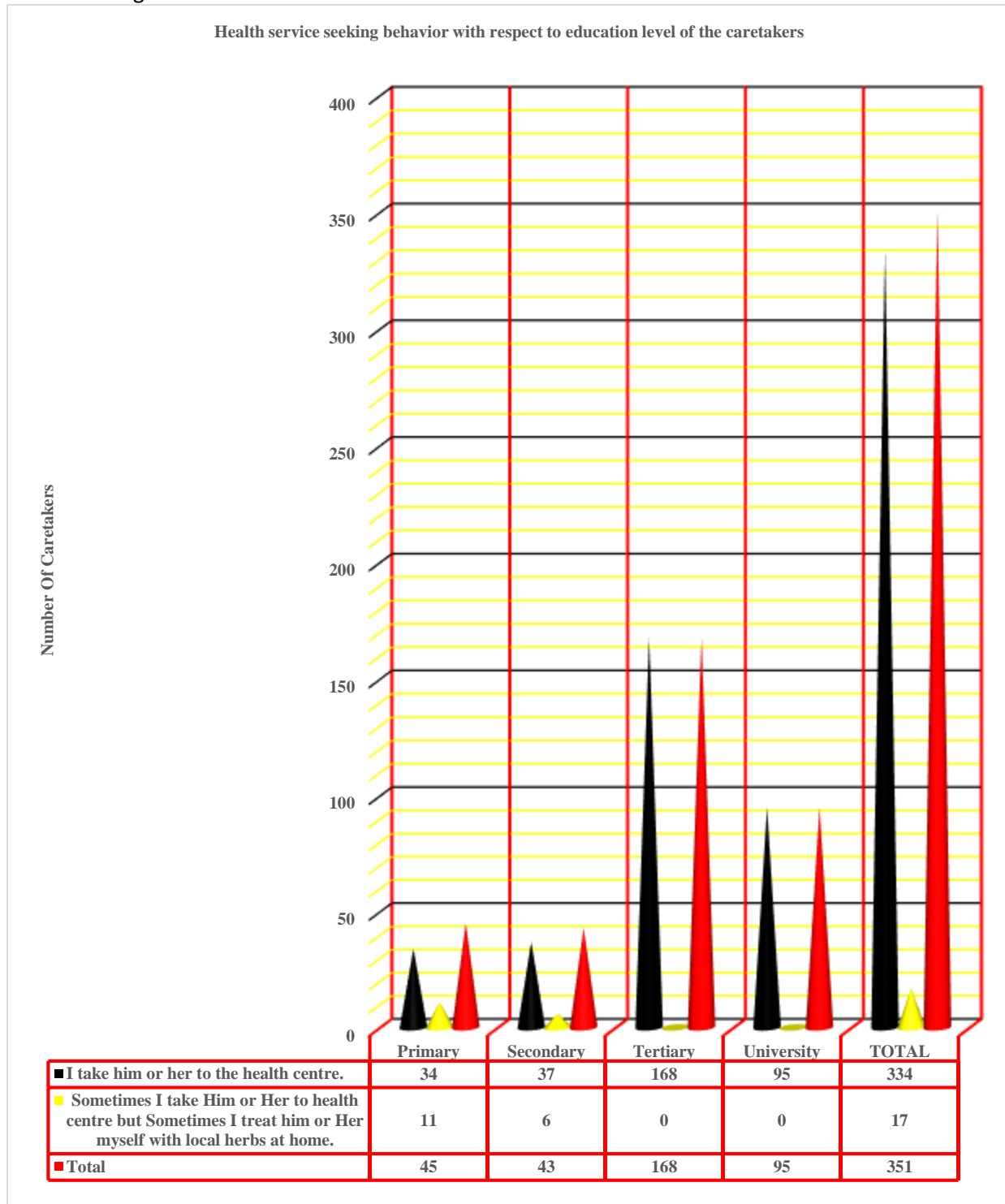


**Table 3: Health Service Seeking Behavior of Caretakers at Hoima Regional Referral Hospital Hoima District, 2021.**

Characteristics	Frequency	Percentage (%)	95% Confidence Interval	
			Lower	Upper
I take him or her to the health centre.	334	95.2	92.6	97.4
Sometimes I take Him or Her to health centre but Sometimes I treat him or Her myself with local herbs at home.	17	4.8	2.6	7.4

Figure 4 depicts the health service seeking behavior with respect to education level of the caretakers where 11(24.4%) of the caretakers who attained primary level and 6(13.9%) of the caretakers who attained secondary level of education sometimes do not take their

children to health centers but rather treat their children with local herbs at home; 168(100%) of caretakers who attained tertiary level and 95(100%) of caretakers who attained university level take their children to the health centre when they develop malaria.



**Figure 4: Health seeking behavior of caretakers for the children on malaria treatment in accordance with Education Level in Hoima**

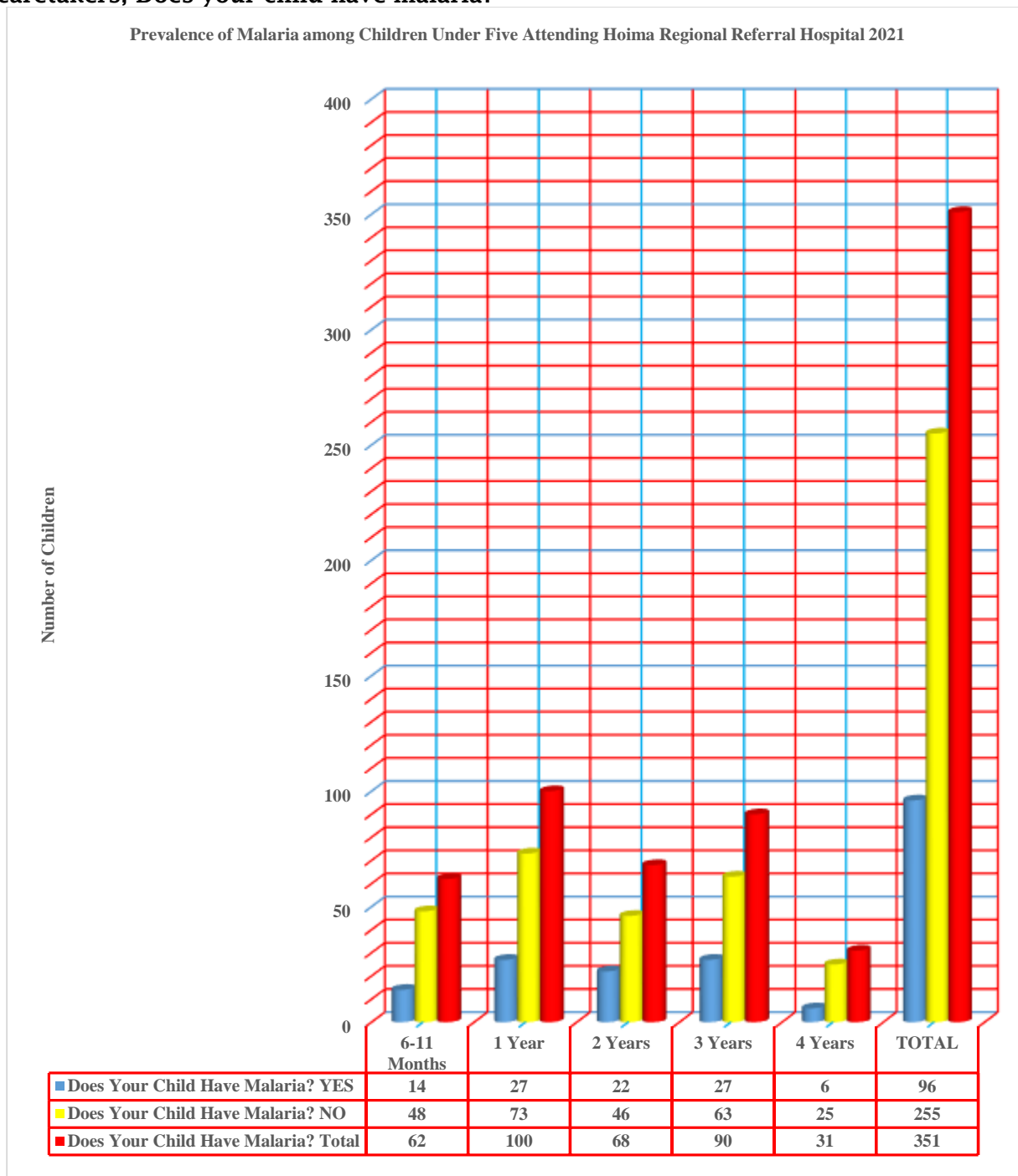
**Table 4: Prevalence of reported malaria in children under the age of five at Hoima Regional Referral Hospital Hoima District, 2021.**

Characteristic	Frequency	Percentage (%)	95% Confidence Interval	
			Lower	Upper
<b>Does Your Child Have Malaria?</b>				
Yes	96	27.4	22.4	31.8
No	255	72.6	68.2	77.6

Figure 5 shows the prevalence of malaria in children under five with a total number of 96 children having malaria accounting for 27.4% of the total study population of 351 children on which the research was conducted. Concerning different children's ages, In the figure, it is depicted that malaria is mostly in children of 1 year and 3 years accounting

for 24(28%) in each age group, this is followed by the age group of 2 years which has several 20(24%) of all children reported to have; Children aged 6-11months with malaria are 12(14%) whereas those of 4 years were 5(6%) of the total number of children reported to have malaria.

**Figure 5: The burden of malaria in children under the age of five attending Hoima Regional Referral Hospital, Hoima District depicted as of the question responded to by caretakers; Does your child have malaria?**



Multivariate Analysis

**Table 5: Factors associated with severe malaria in children under the age of five years HRRH, Hoima District Western Uganda; 2021.**

Predictors	Malaria		AOR	95% Confidence Interval		P-Value
	Yes	No		Lower	Upper	
<b>Care Taker's Education</b>						
Primary	9	36	1.000			0.257
Secondary	17	26	1.333	0.532	3.342	0.539
Tertiary	46	122	0.511	0.226	1.157	0.107
University	24	71	0.878	0.477	1.617	0.676
<b>Occupation</b>						
Casual Laborer	20	59	1.000			0.830
Self-Employed	61	164	0.929	0.500	1.729	0.817
Civil Servant	15	32	0.772	0.331	1.799	0.549
<b>Child's Age</b>						
6-11 Months	14	48	1.000			0.545
1 Year	27	73	0.819	0.256	2.624	0.737
2 Years	22	46	0.627	0.210	1.866	0.401
3 Years	27	63	0.462	0.151	1.418	0.177
4 Years	6	25	0.535	0.181	1.585	0.259
<b>Child's Sex</b>						
Male	44	109	1.000			
Female	52	146	0.947	0.566	1.586	0.837
<b>Health Service Seeking</b>						
Sometimes I take Him or Her to health centre but Sometimes I treat him or Her myself with local herbs at home.	9	8	1.000			0.796
I take child to Health Centre	87	247	3.250	1.141	9.262	0.027

## DISCUSSION

### Prevalence of Malaria in Children Under Five Years Attending HRRH

This study was a cross-sectional study which focused on the determination of factors associated with malaria in children under the age of five attending Hoima Regional Referral Hospital Hoima District-Western Uganda. The study showed that the overall prevalence of malaria among children under five attending HRRH was 27.4% at the instant of data collection based on the responses given by the children's caretakers. This prevalence was shown to be significantly associated with several factors including health service-seeking behaviour, caretaker's education level, mosquito net use habits, child's age and caretaker's occupation which showed the highest

odds of influencing malaria in children under the age of five. The significance of these variables was computed using Pearson's correlation of which health service-seeking behavior was significant with a value of 0.139\*(P=0.021); mosquito net use being significant with a value of 0.286\* (P=0.000); health service seeking behavior was shown to be significant with a value of 0.131\*(P=0.021) with a 2 tailed test at 95% confidence level, P<0.05. Malaria is a leading cause of death among children less than 5 years, who represent 77% of all global malaria deaths, [7, 8]. In Africa a child dies every minute from malaria [1]. Children are mostly affected because their immune systems are not yet fully developed to fight severe forms of disease. Severe malaria occurs due to

delayed treatment of uncomplicated malaria. This stage of disease is defined by the presence of clinical and laboratory evidence of vital organ dysfunction. Almost all death from malaria result from infection with plasmodium falciparum[14] Malaria is easily preventable, curable and treatable, it's still a big health threat and a leading cause of morbidity and mortality to many communities world over most especially in Sub-Saharan Africa. 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 [15]. 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. 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, and early diagnosis and treatment [16]. 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 in the communities, early diagnosis and treatment [16]Uganda has the third highest number of malaria infections in sub-Saharan Africa and some of the highest reported malaria transmission rates in the world. There is stable, perennial malaria transmission in 90-95% of the country. According to 2015 data from Uganda's Health Management Information System (HMIS), malaria accounts for 34% (monthly range, 29-39%)

Prevalence of Malaria in children attending HRRH, Hoima District is high (27.4%). This prevalence is influenced by factors including health service seeking

of outpatient visits and 28% (monthly range 21-39%) of hospital admissions. Of all the reported malaria cases in 2015, an average of 55% was laboratory-confirmed, although this average increased to 64% between July and December. Compared to 2014 HMIS data, hospital admissions decreased by two percentage points (from 30%) in 2015, while laboratory-confirmed cases increased by 16 percentage points (from 39%). Both show a positive trend in malaria case management.[22]. Although these control measures, together with those implemented by numerous non-profit organizations, have successfully reduced the number of Malaria cases in Ugandan children over the past few years, there is still a notably high number of children under five dying from malaria daily [23] Therefore, in order to apply successful implementations to substantially reduce the burden of malaria, there is a continuous need to understand the epidemiology and risk factors associated with the disease[24]. Although a large number of studies done worldwide have identified a wide variety of risk factors; socioeconomic, environmental, demographic, and others, associated with malaria infection, there is still a great need to identify the influence of these factors in a local context to allow a successful formulation of a national malaria-control strategy. The entire population of Uganda is at risk of malaria. 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. This has been associated to stable, perennial malaria transmission in 90-95 percent of the country with the rest of the areas having low and unstable transmission with potential for epidemics, accounting for 34 percent of outpatient visits and 37 percent of hospital admissions[22].

#### CONCLUSION

behavior, mosquito net use habits, caretaker's education, caretaker's occupation and child's age.

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