Correlates and Incidence of *P .falciparum* infection among HIV infected and HIV non- infected Children below 5 years in Kisumu County, Kenya; A Prospective cohort study.

Jack Ogony, Simon Karanja, Henry Athiany

* Jomo Kenyatta University of Agriculture and Technology, P.O. Box 62000 – 00200 Nairobi, Kenya.

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Abstract- Over 3 billion people across the world are at risk of malaria infection every year. This burden is compounded by the fact that approximately 2-3 million children live with human immunodeficiency virus (HIV) in sub-Saharan Africa. Malaria and HIV account for a significant amount of morbidity and mortality with an estimated 22.5 million people living with HIV. While Cotrimoxazole prevents opportunistic infections in HIV-infected persons, its effectiveness in preventing malaria varies especially in children. This study determined the correlates and incidence of *P. falciparum* infection among HIV positive and negative children < 5 years in Kisumu County. Data analysis was done using Stata version 14 statistical. Cumulative incidence of 17.42% was realised over three months follow up. Being a non-parametric test of difference between two groups of non-parametric data, Man-Whitney U test was conducted to assess the difference between malaria incidence in HIV POSITIVE and HIV negative. There was significant difference in incidence of *P. falciparum* among HIV infected compared to HIV non-infected children (p-value = 0.0030). symptoms presented; Fever RR 0.69 (95%CI: 0.22-2.16), headache RR 1.53 (95%CI: 0.12-19.08).Inability to retain oral medication RR 0.12: (95%C: 0.01-1.92), number of persons per bednet use where two, RR 5.46 (95%CI: 0.46-64.58), three 2.14 (95%CI: 0.27-17.25) and > three 2.58 (95%CI: 0.27-24.87) were associated with the risk of malaria.

Index Terms- Correlates, Cotrimoxazole, HIV, cumulative Incidence, P. falciparum.

I. INTRODUCTION

Malaria is caused by infection with one or more of 5 species within the genus *Plasmodium* The greatest burden of disease and death is caused by *Plasmodium falciparum*. Every year over 3 billion people are at risk of malaria, and the disease burden is greatest in infants and young children(1)] While a novel strain of parasite, or other factors such as pregnancy or Human Immunodeficiency Virus (HIV) infection, can alter hard-won partial immunity. Malaria is known to increase viral replication and thus HIV disease progression (2)]. Although not defined as an opportunistic disease (3)],(4)], a malarial episode may become more serious with HIV influence as reported by many studies (5)] (6, 7)]. The main objective of this study was to determine the correlates and incidence of *P. falciparum* in HIV-infected and uninfected children below 5 years in Kisumu city. WHO ranked malaria as the eighth-highest contributor to the global disease burden as reflected in disability-adjusted life years (DALYs), (8)]. Malaria is the leading cause of morbidity and mortality among the children under the age of five years. Death and DALYS due to malaria could be more in high HIV prevalent areas such as Kisumu.

II. METHODOLOGY

Research design: The study adopted a prospective cohort design, used data collected from Kisumu County and Lumumba Sub-County hospitals in Kisumu County, Kenya. Male and female subjects below 5 years followed up for 3 months.

Sample size and sampling technique: A sample size of 132 was taken, samples were selected using purposive sampling technique and data was collected using structured questionnaire and case report forms.

Table 1 inclusion and exclusion criteria

Inclusion criteria	Exclusion criteria
i. A male or female child below 5 years seeking treatment from the Comprehensive Care Clinic (CCC) or Out Patient Department(OPD)/ Mother Child Health (MCH) departments.	i. LAR or parent unwilling or unable to participate in the study including the follow up period.
ii. Malaria Rapid Diagnostic Test (mRDT) negative on the screening date.	ii. Malaria Rapid Diagnostic Test positive on the screening date.
iii. Willingness and ability the parent or guardian to comply with the study protocol for the duration of the study.	iii. Subjects who are on CTX and are HIV negative (HEI).
iv. Subjects who are confirmed to be HIV infected for the exposed group.	iv. Subjects who are on any known malaria prophylaxis.
v. Subjects who are born of known HIV-negative mothers and are HIV non infected for the unexposed group.	v. Any other condition that may result in an unfavorable outcome should the potential subject participate in the study.
vi. Able to give consent and willing to participate in the study and follow up.	

Data collection: The structured questionnaire consisted of 3 parts, part A, giving child level risk factors, part B, depicting the caretaker level risk factors and part C. Showing the house hold level risk factors

Data management and analysis :Data cleaning and validation was performed in order to achieve a clean dataset that was exported from excel of Access database where the original data was collected into a Stata version 14 for analysis .Analysis was conducted using Stata version 14 statistical software(9). Exploratory data techniques were done at the initial stage to uncover the structure of data and identify outliers or unusual entered values. The threshold for statistical significance was set at $p<0.05$. Study being longitudinal Risk Ratio (RR) was appropriate. A generalized estimating equations (GEE) model was customized for logistic regression with poison family to report RR with corresponding 95% CI were used to estimate the strength of association between the retained independent predictors of malaria. We fitted a Proportional Cox regression model to obtain the HR.

Ethical considerations: Written informed consent for the participation in the study was obtained from the Subject's parents or guardians or LAR. The purpose and the role of the study subject was explained clearly to the subjects in English, Kiswahili or dholuo before signing the consent form. Ethical approval was obtained from Independent Ethical Review Committee (ERC.1B/VOL.1/368) of Jaramogi Oginga Odinga Teaching and Referral Hospital (JOOTRH) and (JKUAT).

III. RESULTS

A total of 132 study participants (n=132) with equal distribution of HIV sero-status, HIV- (n=66) and HIV+ (n=66) were recruited into the study. The mean age of males was 2.66 (±1.08) years while the females were 2.91(±1.10) years. The mean age of those who were HIV- was 2.57 (±1.08) years while those who were HIV + were 3.01(±0.95) years. Slightly higher number were females (n=67) than males (n=65). Majority of the subjects106 (80.30%) were able to retain oral medication, while 23(17.42%) were unable whereas 3(2.27%) were sometimes able. Majority 128 (96.97%) of the subjects were being taken care of by their parents, 3 (2.27%)] by house helps, only 1(0.76%) was being taken care of by a relative. Majority 108 (81.82%)] of the care givers were married, while [18 (13.64%) were singles, whereas 9(3.79%) were either separated or divorced and only 1(0.76)] was widowed (Table 3). According to table 4. Majority of the participants [68(51.52%)] reported that 3 persons were sleeping under one LLIN, whereas [36(27.27%)] were sleeping 2 individuals under one LLIN, while [13(9.85%)] were sleeping more than 3 persons under the same LLIN (Table5)

Commutative incidence of malaria was 17.42%, (Table 2). The chi-square test of association between HIV status and Malaria outcome reported Pearson's chi-square p-value=0.003**.** In Table 6, Fever had RR=0.69 (95%CI;0.22-2.16), headache RR=1.53(95%CI;0.12-19.08), Retention of oral medicine RR=0.12(95%CI;0.01-1.92).For the number of persons sleeping under bednet ,two had RR=5.46(95%CI;0.46-64.58), three RR=2.14(95%CI;0.27-24.87) and >three RR=2.58 (95%CI:0.27-24.87).According to Table 7. Children who were taken care of by their parents either father or mother had HR=2.44(95%CI; 0.27-22.19) while those who presented with fever had HR=1.37(95%CI; 0.38-5.34) times of getting malaria infection, those who experienced headache were HR 4.27(95%CI; 0.30-5.04) times at risk of getting malaria.

Table 2 Table of Association

	Malaria Status at the end of observation period		
HIV Status	0pf/ul n (%)	>0pf/ul n (%)	Total
Negative	48 (72.73%)	18(27.27%)	66(100%)

Positive	61(92.42%)	5(7.58%)	66(100%)
Total	109(82.58%)	23(17.42%)	132(100%)

Table 3 Baseline Socio-Demographic and Child level factors

Variable		GENDER		HIV STATUS	
	Overall	**Male (n=65)**	**Female (n=67)**	**HIV- (n=66)**	**HIV+ (n=66)**
	n (%)	**n (%)**	**n (%)**	**n (%)**	**n (%)**
Mean Age(Years)		2.66±1.08	2.91±1.10	2.57±1.18	3.01±0.95
Age Category:					
[0-1]	5(3.79)	3(4.48)	2(3.08)	5(7.58)	0(0.00)
[1-2]	19(14.39)	9(13.43)	10(15.38)	12(18.18)	7(10.61)
[3-4]	36(27.27)	13(19.40)	23(35.38)	17(25.76)	19(28.79)
[4-5]	72(54.55)	42(62.69)	30(46.15)	32(48.48)	40(60.61)
Retain oral antimalarial Medicine					
Yes	106(80.3)	54(83.08)	52(77.61)	65(98.48)	41(62.12)
No	23(17.42)	11(16.92)	12(17.91)	1(1.52)	32(33.33)
Sometimes	4(3.03)	0(0.00)	4(5.97)	0(0.00)	4(6.07)
History of hospitalization					
No	79(59.85)	40(61.64)	39(58.21)	40(60.61)	39(59.09)
Yes	53(40.15)	25(38.46)	28(41.79)	26(39.39)	27(40.91)
History of fever					
Yes	53(40.15)	38(58.46)	41(61.19)	41(62.12)	38(57.58)
No	79(59.85)	27(41.54)	26(38.81)	25(37.88)	28(42.42)
Level of Hospital [a] Referral hospital	7(5.30)	2(3.08)	5(7.46)	3(4.55)	4(6.06)
County hospital	10(5.58)	6(9.23)	4(5.97)	2(3.03)	8(12.12)
Sub County Hospital	36(27.27)	19(29.23)	17(25.37)	20(30.30)	16(24.24)
Health Centre	9(6.82)	5(7.69)	4(5.97)	4(6.06)	5(7.58)
Never been admitted	70(53.03)	33(50.77)	37(55.22)	37(56.06)	33(50.00)
Symptoms Presented					
Abdominal Complications	1(0.76)	1(1.54)	0(0.00)	1(1.52)	0(0.00)
Chronic conditions	1(0.76)	1(1.54)	0(0.00)	0(0.00)	1(1.52)
Common Cold	3(2.27)	1(1.54)	2(2.99)	2(3.03)	1(1.52)
Fever	48(36.36)	27(41.54)	21(31.34)	24(36.36)	24(36.36)
Headache	5(3.79)	2(3.08)	3(4.48)	1(1.52)	4(6.06)
None	73(56.06)	33(50.77)	41(61.20)	38(57.58)	36(4.55)
Duration of Admission					
Never been admitted	71(53.79)	34(52.31)	37(55.22)	34(51.52)	37(56.06)
Less than 1 week	35(26.52)	18(27.69)	17(25.37)	20(30.30)	15(22.73)
Between 2-3 weeks	15(11.36)	7(10.77)	8(11.94)	5(7.58)	10(15.15)
1 month	9(6.82)	4(6.15)	5(7.46)	6(9.09)	3(4.55)
More than 1 month	2(1.52)	2(3.08)	0(0.00)	1(1.52)	1(1.52)
History of malaria infection					
Yes	60(45.45)	32(49.23)	28(41.79)	34(51.52)	60(45.45)
No					

Can't remember	1(0.76)	0(0.00)	1(1.49)	0(0.00)	1(0.76)
Source of antimalarial used					
Bought from chemist	17(12.88)	8(12.31)	9(13.43)	0(0.00)	17(25.76)
Bought from this hospital	10(7.58)	6(9.23)	4(5.97)	3(4.55)	7(10.61)
Given free from this hospital	60(45.45)	30(46.15)	30(44.78)	33(50.00)	27(40.91)
Never been given antimalarial	45(34.09)	21(32.31)	24(35.82)	30(45.45)	15(22.73)

[a]Level of the hospital that the child was admitted to when sick

Table 4 Descriptive analysis of Care giver level factors.

VARIABLES		GENDER		HIV STATUS	
	Overall (n %)	Male (n=65)	Female (n=67)	HIV- (n=66)	HIV+ (n=66)
Child Caretaker					
House help	3(2.27)	1(1.54)	2(2.99)	1(1.52)	2(3.03)
Mother/Father	128(96.97)	64(98.46)	64(95.52)	65(98.48)	63(95.45)
Relative	1(0.76)	0(0.00)	1(1.49)	0(0.00)	1(1.52)
Marital Status of caregiver					
Married	108(81.82)	51(78.46)	57(85.08)	59(89.39)	49(74.24)
Single	18(13.64)	10(15.38)	8(11.94)	6(9.09)	12(18.18)
Divorced/Separated	9(3.79)	2(2.99)	3(4.62)	1(1.52)	4(6.06)
Widowed	1(0.76)	0(0.00)	1(1.54)	0(0.00)	1(1.52)
Medication giver[b]					
House help	3(2.27)	2(3.08)	1(1.49)	0(0.00)	3(4.55)
Mother/Father	127(96.21)	63(96.92)	64(95.52)	66(100.00)	61(92.42)
Relative	2(1.52)	0(0.00)	2(2.99)	0(0.00)	2(3.03)
Level of Education					
Never	7(5.30)	4(5.97)	3(4.62)	1(1.52)	6(9.09)
Pre-school	2(1.25)	0(0.00)	2(3.08)	0(0.00)	2(3.03)
Primary	34(25.76)	18(26.87)	16(24.62)	10(15.15)	24(36.36)
Secondary	34(25.76)	16(23.88)	18(27.69)	12(18.18)	22(33.33)
Tertiary	55(41.67)	29(43.28)	26(40.00)	43(65.15)	12(18.18)
Hospital Taker [c]					
Mother	130(98.48)	64(98.46)	66(98.51)	2(3.03)	64(96.97)
Father	2(1.52)	1(1.54)	1(1.49)	0(0.00)	66(100.00)
Occupation of caregiver					
Employed	22(16.67)	11(16.92)	11(16.42)	10(15.15)	12(18.18)
None	39(29.55)	20(30.77)	19(28.36)	27(40.91)	12(18.18)
Self-employed	71(53.75)	34(52.31)	37(55.22)	29(43.94)	42(63.64)
Working Hours					
Day time 8am-5am	65(49.24)	30(46.15)	35(52.24)	42(63.64)	23(34.85)
Day time half day	34(25.76)	17(26.15)	17(25.37)	0(0.00)	34(51.52)
None	31(23.48)	18(27.69)	13(19.40)	24(36.36)	7(10.61)

Night time 8pm-6am	1(0.76)	0(0.00)	1(1.49)	0(0.00)	1(1.52)
Night time half night	1(0.76)	0(0.00)	1(1.49)	0(0.00)	1(1.52)

Medication giver[b] –The person giving medication to the child if fell sick
Hospital Taker[c] - The person who takes the child to the hospital when she/he is sick.

Table 5 Descriptive analysis of the Household-level factors

VARIABLES		GENDER		HIV STATUS	
	Overall	Male (n=65)	Female (n=67)	HIV- (n=66)	HIV+ (n=66)
	n (%)	n (%)	n (%)	n (%)	n (%)
Residential area					
Rural area	22(16.67)	10(15.38)	12(17.91)	6(9.09)	16(24.24)
Urban area	109(82.57)	55(84.62)	54(80.60)	60(90.91)	49(74.24)
Other	1(0.76)	0(0.00)	1(1.94)	0(0.00)	1(1.52)
Bed nets available per house hold					
One	31(23.48)	16(24.62)	15(22.39)	21(31.82)	10(15.15)
More than one	85(64.39)	43(66.15)	42(62.59)	34(51.52)	51(77.27)
None	16(12.12)	6(9.23)	10(14.93)	11(16.67)	5(7.58)
Number of Persons per bednet					
Two	36(27.27)	18(27.69)	18(26.87)	5(7.58)	31(46.97)
Three	68(51.52)	35(53.85)	33(49.25)	39(59.09)	29(43.94)
More than three	13(9.85)	6(9.23)	7(10.45)	11(16.67)	2(3.03)
No bednet	15(11.36)	6(9.23)	9(13.43)	11(16.67)	4(6.06)
Availability of bed nets at the Resident					
Yes	38(28.79)	14(21.54)	24(35.82)	23(34.85)	15(22.73)
No	10(7.57)	5(7.69)	5(7.46)	3(4.55)	7(10.61)
Not sure	84(63.64)	46(70.77)	38(56.72)	40(60.61)	44(66.67)
Presence of waterlogs near residential					
Yes	44(33.33)	18(27.69)	26(38.81)	17(25.76)	27(40.91)
No	86(65.15)	46(70.77)	40(59.70)	49(74.24)	37(56.06)
Not sure	2(1.52)	1(1.54)	1(1.49)	0(0.00)	2(3.03)
Use of mosquito repellants					
Yes	65(49.24)	34(52.31)	31(46.27)	32(48.48)	33(50.00)
No	66(50.00)	30(46.15)	36(53.73)	34(51.52)	32(48.48)
Not sure	1(0.76)	1(1.54)	0(0.00)	0(0.00)	1(1.52)
Nature of Household					
Permanent with electricity	52(39.39)	26(40.00)	26(38.81)	31(46.97)	21(31.82)
Permanent without electricity	11(8.33)	5(7.69)	6(8.96)	1(1.52)	10(15.15)
Semi-permanent with electricity	56(42.42)	27(41.54)	29(43.28)	28(42.42)	28(42.42)
Semi-permanent without electricity	13(9.85)	7(10.77)	6(8.96)	6(9.09)	7(10.61)

Table 6 Calculations of Relative Risk of the selected risk factors

	HIV-	HIV+
Overall Risk Factors	**Relative Risk (95% CI)**	**Relative Risk(95% CI)**
Child Caretaker		
House help	Ref	Ref
Mother/Father	0.00(0)	2.31(0.33, 8..95)
Relative	N/A	4.60(0)
Symptoms Presented		
Abdominal complications	0.00(0)	N/A
Chronic conditions	N/A	0.00(0
Common Cold	0.00(0)	0.00(0)
Fever	0.69(0.22, 2.16)	1.28(0.17, 9.62)
Headache	1.53(0.12, 19.08)	0.00(0)
Others	3.92(0.47, 32.40)	0.00(0)
None	Ref	Ref
Retain Oral Medicine		
No	Ref	Ref
Sometimes	N/A	0.00(0)
Yes	0.12(0.01, 1.92)	0.19(0.02, 1.89)
Number of Persons Sleeping under one bednet		
Two	5.46(0.46, 64.58)	5.35(0.36, 8.99)
Three	2.14(0.27, 17.25)	2.37(0.66, 25.36)
> three	2.58(0.27, 24.87)	5.13(0.53, 32.51)
None	Ref	Ref

NA (Not Available) statistics omitted due to collinearity

Table 7 .Cox proportional Hazard Ratios

	HIV-	HIV+
Overall Risk Factors	**Hazard Ratios (95% CI)**	**Hazard Ratios (95% IC)**
Child Caretaker		
House help	Ref	Ref
Mother/Father	2.44(0.27, 22.19)	1.00(0)
Relative	N/A	N/A
Symptoms Presented		
Abdominal complications	N/A	N/A
Chronic conditions	N/A	N/A
Common Cold	1.00(0)	N/A
Fever	1.37(0.38, 5.34)	0.00(0)
Headache	4.27(0.30, 5.04)	N/A
Others	7.94(0.65, 96.97)	N/A
None	Ref	Ref
Ability of the child to retain oral Medicine		
No	Ref	Ref
Sometimes	1.00(0)	N/A
Yes	1.00(0)	0.00(0)
Number of people Sleeping Under one bednet		
Two	0.32(0.02, 4.39)	1.00(0)

Three	0.24(0.02, 2.53)	N/A
More than three	0.20(0.01, 2.73)	1.00(0)
None	Ref	Ref

IV. DISCUSSION

Study done by (10)] found a prevalence of 17% of malaria in children under 5 years in endemic areas, our study realized cumulative incidence of 17.42%, with higher proportion of the subject who suffered malaria being HIV negative (22.27%) compared to HIV positive (7.58%)**.** Our findings are in agreement with a cohort study of HIV-infected children in Kampala, Uganda to estimate the protective efficacy of trimethoprim-sulfamethoxazole (TMP/SMX) prophylaxis and ITNs on the incidence of malaria and concluded that combined use of TMP/SMX prophylaxis and insecticide-treated bed nets was associated with a dramatic reduction in malaria incidence among HIV-infected children (11)]. Current vigorous PMTC services, periodic HEI clinical checkups improves their wellbeing as opposed to the HIV negative counterparts.

Inability to retain oral antimalarial medication and *P. falciparum* infection outcome: It is essential to achieve effective antimalarial drug concentrations for a sufficient time to ensure high cure rates. According to WHO, Artemisinin-combination therapies (ACTs) currently represent first-line treatment of uncomplicated *P. falciparum* malaria and exhibit excellent efficacy and the potential to minimize development of drug resistance. According to Darren et al., in their study to determine the increased risk of early vomiting among infants and young children treated with Dihydroartemisinin-Piperaquine compared with AL for uncomplicated malaria, the ACTs appeared to be well-tolerated and with rare toxicities (12)],(13)],(14)],(15)]. Early vomiting has been shown to reduce the effectiveness of ACT antimalarial therapies because of reduced drug absorption. In our study, although majority 106(80.3%) of the study subjects were able to retain oral antimalarial, about 23 (17.42%) could not retain oral ACT. Those who were able Ability to retain oral medication were 0.12 times RR=0.12 (95%CI; 0.08-1.92) less likely to get malaria infection as compared to those who were able to retain oral medication. (16) examined the risk of early vomiting in a multivariate analysis found that risk of early vomiting was significantly higher in all participants less than 18 months of age.

Bed net use and *P. falciparum* infection :Long-lasting insecticidal nets (LLINs) are effective interventions for reducing the burden of malaria (17)]. According to President Malaria Initiative operation Plan FY 2018, LLINs are defined as one net per two people. In this study, although the results are not statistically significant, we realized that two people sleeping under one LLIN were 5.46 times [(RR=5.46; 95%CI; 0.46-64.58)], at risk of getting malaria infection than if they were three [(RR=2.14:95%CI; 0.27-17.25) per bed net. The recommended ration of two persons per bed net could be effective for two adults while for children chances are that they could roll towards the bed net edge therefore exposing the child to mosquito bite. Previous studies show that large-scale, free net distribution campaigns can reduce inequities in household net ownership across socio-economic gradients (18)], ,(19)],(20)],(21)],(22)]. Socioeconomic factors, such as household wealth and education, have also been identified as consistent and important predictors of mosquito net acquisition (19)],(17)],(23)].

Influence of Child Care takers factors on *P.falciparum* :Study by (24)] suggested that knowledge is not sufficient enough to drive LLIN use and care seeking. In their study, caretakers recognized malaria mostly by chills (70.4%, 499/709), fever (45.7%, 324/709) and headache (39.8%, 282/709).Majority, 72.2% (512), of the caretakers knew that sleeping under LLIN could prevent malaria. Our study showed that the subjects who were being taken care of by their parents were 2.4 times [HR=2.44:95%CI; 0.27-22.19] at risk of developing malaria than their counterparts. Another study by (25)] in determining malaria-related knowledge, attitude and practices (KAP) among primary caregivers, a total of 90% of respondents reported mosquitoes and/or malaria as the cause of fever. Higher levels of education for the caregiver were associated with positive malaria-related KAP. Their independent predictors of malaria incidence, were also similar to the risk factors in our study.

Symptoms associated and *P.falciparum infection* :Study done in Kenyan (26)], concluded that fever is a sensitive indicator of clinical malaria in children <5 years,. Adding headache to fever as screening symptom increases sensitivity of detection at the cost of decreased specificity. Guidelines for treatment of malaria in Kenya says first symptoms of malaria are nonspecific and similar to those of a minor systemic viral illness(27).In this study 48(36.36%) experienced fever, 5 (3.79%) experienced headache, The study showed that those who had headache were 1.53 times [RR=1.53:95%CI; 0.12-19.08] more likely to have malaria compared to those who experienced fever [RR=0.69:95%CI; 0.12-1.92].

V. CONCLUSIONS

The study found cumulative incidence of malaria at 17.42%, with higher proportion (22.27%) of the subject who suffered *P.falciparum* being HIV negative compared to HIV positive (7.58%). There was a relatively weak inverse relationship (Cramer's V of -0.2596) between HIV status and malaria outcome consequently higher number of subjects reporting *P.falciparum* positive were HIV negative. Inability to retain oral antimalarial medication and presence of fever and headache were predisposing factors to malaria infection. Similarly the individual taking care of the child is also a source of risk to *P.falciparum* infection. Children who were taken care of by their parents were more prone to *P.falciparum* infection as compared to the other groups of child care taker. Lastly and the use of long lasting insecticide treated nets showed that the ratio of persons to one net directly affected infection with *P.falciparum*. Children should be maintained at the middle of the bed.

VI. RECOMMENDATIONS

We recommend that it is important ensure that a child retain oral antimalarial to enhance its absorption, we recommend that policies should be created to emphasise the Direct observe therapy (DOT) at the facility level with continuous health education. There is also need to promote and encourage and even follow up on availability and proper use of the LLINs as an intervention to *P. falciparum* control among the children under 5 years. The package of the use of the LLIN should include the recommended ratio of persons to one LLIN. Although it is existing in some facilities, there is still need to emphasize to the health care givers to consistently give heath talks to the patient /child care takers during their visits to the health facilities and even through the use of media such as radio or television ensure the knowledge for taking care of the child is universal.

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AUTHORS

First Author: Jack Ogony, MSc Epidemiology student, Jomo Kenyatta University of Agriculture and Technology.
Email: Ogonyjack@gmail.com
Second Author: Simon Karanja, PhD, Associate Prof, Medical Epidemiology
Dean, School of Public Health .Jomo Kenyatta University of Agriculture and Technology.
Email: skaranja@jkuat.ac.ke

Third Author: Henry Athiany, MSc MSc MPhil,
Department of Statistics and Actuarial Sciences, Jomo Kenyatta University of Agriculture and Technology.
Email: henry.athiany@jkuat.ac.ke

Corresponding author: Jack Ogony:
Email: Ogonyjack@gmail.com , alternative email address, dimmitrijack@yahoo.com.
Cell phone +254723107953.