

Factors Associated with Utilization of Malaria Preventive and Control Measures Among Pregnant Women Attending Antenatal Clinic at Kisumu County Referral Hospital in Kisumu City Western Kenya

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Abstract :-

➤ Background

In Kenya, one of the strategies to control malaria during pregnancy is through the use of intermittent preventive treatment of malaria in pregnancy (IPTp) and insecticide-treated bed nets (ITNs) in conjunction with other intervention methods. But the uptake of these services among pregnant women is not fully optimized. The study assessed the knowledge on malaria and determined factors associated with utilization of malaria preventive and control measures among pregnant women in Kisumu City.

➤ Method

A descriptive cross sectional study design was used during the survey, it was a one-point survey and the participants were met only once with no follow up done. A random sampling technic was employed and quantitative data collection method used. The method allowed the investigator to measure disease knowledge of the study participants and determined economic and demographic factors associated with utilization of malaria preventive and control measures among pregnant women in the study area. A total of 349 pregnant women aged between aged 14-49 years, with viable pregnancy (any gravidae) who had stayed in the study area for the last six months, attended ANC at Kisumu County Referral Hospital (KCRH) were enrolled in the study in the study. A structured questionnaire was used to collect data on knowledge level on malaria disease, social - economic and demographic factors that were associated with utilization of malaria prevention and control measures among pregnant women. Sample size was calculated based on malaria prevalence of 28% in the study area. Binary logistic regression, chi square and multivariate analysis (p < 0.05) were used to determine if there was any association for the categorical variables with

utilization of malaria preventive and control measures among pregnant women.

➤ Results

The finding reported knowledge levels about signs and symptoms of malaria was at 95.42%, malaria transmission at 90.54%, impact of malaria at 65.04%, malaria intervention methods at 89.68% and IPTp was at 57.59%. The main factors associated with utilization of malaria preventive and control measures among pregnant women were knowledge of malaria intervention methods (AOR 3.16, 95% C.I 1.38-7.21, p=0.006), knowledge of IPTp as malaria preventive method (AOR=4.55, 95% CI=2.44-8. p=0.001), permanent employment and employment (AOR 2.08, 95% C.I, 1.12-3.84, p=0.02). In this study, participants education was not statistically significant.

➤ Conclusion

The data from this study has shown risk of malaria in pregnant women within Kisumu city is high. The findings reported knowledge on disease transmission, signs and symptoms, sources of information and complications involved during pregnancy affected utilization of malaria preventive and control measures by the respondents. A bigger proportion of the respondents had knowledge on malaria intervention methods but use of IPTp as malaria intervention method was low. However, knowledge and use of Coartem® as antimalarial was high by the respondents. The finding also reported that socioeconomic factors influenced the utilization of malaria preventive and measures by the respondents. Demographic factors of the participants influenced utilization of malaria preventive and control measures by the respondents.

Keywords:- ITN Use, IPTP Uptake, Malaria Prevention and Control Interventions, Pregnant Women, Knowledge of Malaria Disease, Factors Associated with Utilization of

Malaria Prevention and Control Measures, Malaria Interventions Methods.

I. INTRODUCTION

The World Health Organization (WHO) estimates 3.2 billion people are at risk of malaria globally (WHO 2018). Malaria kills around 500,000 people annually and causes around 216 million clinical cases globally with Africa bearing the brunt of malaria associated morbidity and mortality (Muhumuza, Namuhani *et al.* 2016, WHO 2018, Rakotoarison, Rasamimalala *et al.* 2020). In poor resource settings such as Africa, it is pregnant women and children under five years that are more vulnerable to the disease with a approximately 10,000 maternal death and 75,000 to 200,000 child deaths reported annually due Malaria in pregnancy (MiP) and 100,000 neonatal deaths due to low birth weight due to *P. falciparum* infection during pregnancy (WHO 2018). Malaria in pregnancy (MiP) is associated with complications such as abortion, anemia, low birth weight, intrauterine growth retardation, placental malaria, congenital infections, premature deliveries and still birth, the complications are dangerous to the mother and the unborn child (Oladokun, Oladokun *et al.* 2011, Rakotoarison, Rasamimalala *et al.* 2020). In Kenya, 70% of the country's population is at risk of malaria infection and the burden is high around Lake Victoria and the coast regions having prevalence of 8% and 28% respectively (Jenkins, Omollo *et al.* 2015, WHO 2017). Annually it is estimated that there are 1.5 million pregnancy that occur in Kenya with 44% of these pregnancies occurring in malaria endemic zones (KHIS, 2019). In 2018, the country MiP prevalence stood at 4918 cases per 100,000 persons (Mutanyi, Onguru *et al.* 2021).

To control MiP in malaria endemic zones, WHO recommends the use of ANC platform to deliver intermittent preventive treatment in pregnancy with sulfadoxine–pyrimethamine (IPTp-SP) from the second trimester at each scheduled antenatal care (ANC) visit until delivery with at least one month interval between the doses and use of long lasting insecticidal nets (LLINs) coupled with effective case management of clinical malaria and anaemia during pregnancy (González, Desai *et al.* 2014, Desai, Gutman *et al.* 2015). SP is safe, efficacious and cost effective for IPTp and has been shown to reduce MiP cases, low birth weight, risk of placental malaria and neonatal deaths (KANCO 2019). It has also been associated with increasing maternal haemoglobin (Desai, Gutman *et al.* 2015). In line with the WHO recommendations, the Kenya ministry of health (MOH) recommend that pregnant women from malaria endemic regions should receive at least three doses of IPTp (IPTp-sp3+) (Muhumuza, Namuhani *et al.* 2016). Global strategy for malaria control and prevention includes: early diagnosis, quick treatment and Integrated Vector Management (IVM) for vector control (Tobgay, Torres *et al.* 2011, Douglas, Burkot *et al.* 2021).

In Kenya the risk of death is higher in children and pregnant women, however adult population acquire partial immunity (Jenkins, Omollo *et al.* 2015). Malaria

transmission is variable in Kenya because of the different transmission intensities driven by climatic and temperature changes (Githeko, Ototo *et al.* 2012). The Kenya ministry of health (MOH) and WHO recommends that pregnant women from malaria endemic regions should receive at least three doses of IPTp (WHO 2017, Anchang-Kimbi, Kalaji *et al.* 2020, Mutanyi, Onguru *et al.* 2021). ITNs coverage in the area is at 95% (Ng'ang'a, Aduogo *et al.* 2021), however the use of these interventions by the pregnant women is not maximized as per the WHO and MOH recommendations.

Utilization of disease interventions by the pregnant women comes with a lot of challenges. (Oladokun, Oladokun *et al.* 2011). The effectiveness of these interventions depends on the pregnant women's knowledge, attitude, behaviors and the wider community shaped by socio-economic and demographic factors (Hlongwana, Mabaso *et al.* 2009). Among the predictors of optimal IPTp-SP include maternal knowledge of IPTp-SP benefits in conjunction with recommended doses of IPTp (Mutanyi, Onguru *et al.* 2021). In poor resource settings of Sub-Saharan, low utilization of malaria preventive and control measures among pregnant women has also been associated (Oladokun, Oladokun *et al.* 2011). The optimal utilization of malaria preventive and control measures among pregnant women is influenced by various factors including socio-demographic and economic factors (Yaya, Uthman *et al.* 2018, Mutanyi, Onguru *et al.* 2021). The other challenge with control of MiP is the misuse of Insecticide Treated Nets (ITNs) for fishing/drying fish and crop protection, due to lack of knowledge on its effectiveness for malaria control has also led to increased disease prevalence in malaria endemic regions (Forty and Keetile 2021). The other challenge with control of MiP is the misuse of Insecticide Treated Nets (ITNs) for fishing/drying fish and crop protection, due to lack of knowledge on its effectiveness for malaria control has also led to increased disease prevalence in malaria endemic regions (Forty and Keetile 2021).

Increased access and utilization of utilization of malaria preventive and control measures among pregnant women is critical in the reduction of MiP burden. This study therefore sought to assess knowledge level about malaria and factors associated with utilization of malaria preventive and control measures among pregnant women in Kisumu city, western Kenya for improved access to and optimization of the interventions.

II. METHODS

➤ Study Design and Setting

A descriptive cross sectional study design was used during the survey that utilized quantitative data collection tools. The study was conducted in Kisumu County Referral Health Facility which is centrally located in Kisumu city, Kisumu County in Western Kenya. The hospital lies within longitudes 33°20'E and latitudes 0°50'. It covers an area of approximately 417 km squared with a population density of 820 per square kilometer (Odhiambo, Atieli *et al.* 2019) The area is composed of different ethnic groups namely; Luos, Luhya, Kisii, Hindu

e.t.c (Jenkins, Omollo *et al.* 2015). The site was selected due to its centrally location and it's the largest level 4 public-sector hospital in Kisumu County, hence hospitalizes substantial number of pregnant women at ANC at its out patient. The disease prevalence is at 28% (Otambo, Olumeh *et al.* 2022) with malaria microscopy, while malaria rapid diagnostic test at 33.5% (Noguchi, Grenier *et al.* 2020). In Kisumu city, the most common species of malaria is *plasmodium falciparum* (Ogony, Karanja *et al.* 2021). In the area, a number of malaria intervention methods i.e IPTp and ITNs for pregnant women are available in health care set ups at the ANC platform.

The use of these intervention methods have not been fully optimized (Mutanyi, Onguru *et al.* 2021). The use of these intervention methods have not been fully optimized (Mutanyi, Onguru *et al.* 2021). A approximately 56% of pregnant women receive at least two.

IPTp-SP doses, 38% receive at least three doses of IPTp-SP and about 58% of them sleep under ITNs (Noguchi, Grenier *et al.* 2020). In the area, a number of malaria intervention methods i.e IPTp and ITNs for pregnant women are available in health care set ups at the ANC platform. The use of these intervention methods have not been fully optimized (Mutanyi, Onguru *et al.* 2021) The high disease prevalence in the city comes with a lot of risks and challenges to the pregnant women (Ochieng, Kakai *et al.* 2011). A approximately 56% of pregnant women receive at least two IPTp-SP doses, 38% receive at least three doses of IPTp-SP and about 58% of them sleep under ITNs (Noguchi, Grenier *et al.* 2020). The high disease prevalence in the city comes with a lot of risks and challenges to the pregnant women (Ochieng, Kakai *et al.* 2011).

➤ Target and Study Population

The targeted population were pregnant women who attended ANC clinics in Kisumu central referral hospital located within the city. The study population included pregnant women with viable pregnancy (any gravidae) aged 14-49 years, attended ANC at KCRH, residents of Kisumu city who had stayed in the study area for the last six months, were willing to participate in the study and signed informed consent, Those who had not stayed in the study area for six months, not willing to give informed consent and suspected to have mental disorders were excluded from the study.

➤ Study Variables

The dependend variable was utilization of malaria preventive and control measures among pregnant women. Table 1 shows independent variable and their definations.

➤ Data Collection

A validated semi structured questionnaire was used to collect both dependent and independent variables using a face to face interviews by trained research assistants. Data on disease knowledge, socio - economic and demographics factors associated with utilization of disease prevention and control measures were collected from the study participants. In addition to data collection, verification on accurate entries

was done by a qualified personnel before data entries.

➤ Sample Size and Sampling

The sample size was calculated based on malaria prevalence in the Lake Victoria region which is malaria endemic zone. The current malaria prevalence for pregnant women in the region is (28%) (Jenkins, Omollo *et al.* 2015, Otambo, Olumeh *et al.* 2022). a 95% confidence interval, a 5% precision and 10% non non-response rate. The final sample size was 349.

- Cochran's formula was used to determine and arrive at the required sample size, this was calculated as below:

$$n_o = \frac{Z^2 pq}{e^2}$$

Where

- ✓ Z = normal standard deviation at 95% confidence level = 1.96
- ✓ P = Proportion of pregnant women with malaria (28%), (Ouma *et al.*, 2015).
- ✓ q = 1-p =0.82 (proportion of pregnant women without malaria)
- ✓ e = level of precision= 0.05
- ✓ Thus;
- ✓ Number= $(1.96)^2 \times 0.28 \times 0.82 / (0.05)^2 = 3.8416 \times 0.2016 / 0.0025 = 310$
- ✓ A none response rate of 10% was added to the minimum sample size to cater for possible refusals and this was calculated as below:
- ✓ $(310 \times 10 / 100) = 31$
- ✓ Calculated sample size = $310 + 31 = 341$

The expected sample size was 341, however during data collection, systemic sample collection technic was used and 349 participants were enrolled, recording 8 more participants.

A random sampling method was used to enroll study participants, all pregnant women who came for ANC at KCRH hospital were approached by two trained community health workers (CHWS). The CHWS were deemed competent by the researcher before they were allowed to undertake any study procedures. During data collection the trained CHWs gave detailed information about the study to the pregnant women. The women were allowed to make informed decision on their participation in the study. All women were given equal chance to be enrolled in the study. This method gave a fairly representative sample from the entire population under investigation.

➤ Statistical Analysis of Data.

This study employed quantitative analysis involving both descriptive and inferential analysis. The descriptive data was normally distributed, continuous variables were described by calculating mean and standard deviations while proportions were used to describe categorical variables. CRFs data was imported into Stata version 14 (Stata Corp College Station, Texas, 77845 USA) and merged for analysis.

Associations for categorical variables were analysed using. B nary regression was used to determine the degree of association between the variables and chi-square test used to determine if there was any association in utilization of malaria preventive and control measures across all the demographic and social factors. A cut off level of 5%. (0.05) was considered to be statically significant in this study.

➤ *Ethical Considerations*

Ethical approval was obtained from Jaramogi Oginga Odinga University of Science and Technology Ethics Review Committee(Approval number IERC/JOOTRH/319/20). Study participants provided written informed consent. Privacy and confidentiality of the study participants and all raw data was observed during data storage and analysis.

III. RESULTS

➤ *Demographics and Social Characteristics of Study Participants Enrolled*

A total of 349 pregnant women from Lake Victoria malaria endemic region and presented themselves for ANC visits at Kisumu Central Referral Hospital were enrolled in the study. Data on participant’s knowledge, demographics and social economic characteristics were taken and analysed. **Table 1** shows socio-demographic characteristics of the study participants. Most of the participants were of age group between 25-34yrs (177, 38.1%) with a mean±SD of 26.32±5.54. Majority had one child (133,38.1%), (249 ,71.4%) were Luos, 292 (83.67 %) married, (334, 95.7%) were christians and most (140, 40.1%) of the participants had secondary education. (**table 1**)

Table 1 Demographic Characteristics of the Participants

Variables	N(%)	Didn't use Malaria Preventive and Control Measures; n(%)	Used Control Measures; n(%)
Age group			
Below 20 years	39(11.17)	13(33.33)	26(66.67)
21-25 years	133(38.11)	42(31.58)	91(68.42)
26-30 years	101(28.94)	23(22.77)	78(77.23)
31-35 years	56(16.05)	6(10.71)	50(89.29)
36 and above	20(5.73)	7(35)	13(65)
No. of children			
0	87(24.93)	30(34.48)	57(65.52)
1	133(38.11)	32(24.06)	101(75.94)
2	75(21.49)	17(22.67)	58(77.33)
3	40(11.46)	9(22.5)	31(77.5)
≥ 4	14(4.01)	3(21.43)	11(78.57)
Tribe			
Didn't disclose	20(5.73)	7(35)	13(65)
Kalenjin	6(1.72)	3(50)	3(50)
Kikuyu	5(1.43)	1(20)	4(80)
Kisii	16(4.58)	3(18.75)	13(81.25)
Luhya	40(11.46)	8(20)	32(80)
Luo	249(71.35)	66(26.51)	183(73.49)
Maasai	2(0.57)	1(50)	1(50)
Muganda	3(0.86)	0(0)	3(100)
Other	7(2.01)	2(28.57)	5(71.43)
Kamba	1(0.29)	0(0)	1(100)
Marital status			
Married	284(81.38)	72(25.35)	212(74.65)
Single	57(16.33)	18(31.58)	39(68.42)
Divorced	4(1.15)	0(0)	4(100)
Widowed	4(1.15)	1(25)	3(75)
Religion			
Christianity	334(95.7)	88(26.35)	246(73.65)
Muslim	15(4.3)	3(20)	12(80)
Level of education			
Primary	60(17.19)	19(31.67)	41(68.33)
Secondary	140(40.11)	41(29.29)	99(70.71)
College/university	132(37.82)	25(18.94)	107(81.06)
None	17(4.87)	6(35.29)	11(64.71)

➤ *Knowledge About Malaria and Utilization of Malaria Preventive and Control Measures*

This study compared how knowledge levels about malaria influenced utilization of malaria preventive and control measures. As shown in **table 2**, majority of the participants had knowledge on impact of malaria (227, 65%), transmission of malaria (316,90.5%), signs and symptoms of malaria (333,95.4%), malaria intervention methods (313,89.7%) and IPTp (201,57.6%). Majority of participants identified headache (265,75.9%), nausea (180, 51.6%) and sweating (189,54.2%) as symptoms of malaria while majority did not identify body ache (206, 59%), stomach ache (236,67.6%), sour/ bitter taste in mouth (233, 66.8%) and loss of appetite (191,54.7%) as symptoms of malaria. In addition, a higher proportion of participants were not aware that abortion (234, 67.1%), low birth weight (224,64.2%), anemia (268, 76.8%) and premature deliveries (258,73.9%) are complications associated with malaria during pregnancy. Pearson Chi-square and Fisher's exact test results in table 2 shows that utilization of malaria preventive and control methods was significantly associated with knowledge on impact of malaria ($p<0.001$), transmission of malaria ($p=0.025$), signs and symptoms of malaria ($p=0.026$) including; headache ($p=0.009$) and sweating ($p=0.012$), malaria intervention methods ($p<0.001$) and IPTp ($p<0.001$).

Table 2 Knowledge Levels on Malaria and Utilization of Malaria Preventive and Control Measures by the Participants.

Variables		N (%)	Don't use Malaria Preventive and Control Measures n (%)	Use Malaria Preventive and Control Measures n (%)	P value
Knowledge on impact of malaria					
	Yes	227(65.04)	44(19.38)	183(80.62)	<0.001
	No	122(34.96)	47(38.52)	75(61.48)	
Transmission knowledge					
	Yes	316(90.54)	77(24.37)	239(75.63)	0.025
	No	33(9.46)	14(42.42)	19(57.58)	
Knowledge on signs and symptoms					
	Yes	333(95.42)	83(24.92)	250(75.08)	0.026
	No	16(4.58)	8(50)	8(50)	
Malaria signs and symptoms					
Headache	Yes	265(75.93)	60(22.64)	205(77.36)	0.009
	No	84(24.07)	31(36.9)	53(63.1)	
Nausea	Yes	180(51.58)	40(22.22)	140(77.78)	0.091
	No	169(48.42)	51(30.18)	118(69.82)	
Body ache	Yes	143(40.97)	28(19.58)	115(80.42)	0.021
	No	206(59.03)	63(30.58)	143(69.42)	
Stomach ache	Yes	113(32.38)	22(19.47)	91(80.53)	0.052
	No	236(67.62)	69(29.24)	167(70.76)	
Sweating	Yes	189(54.15)	39(20.63)	150(79.37)	0.012
	No	160(45.85)	52(32.5)	108(67.5)	
Sour/ bitter taste in mouth	Yes	116(33.24)	22(18.97)	94(81.03)	0.033
	No	233(66.76)	69(29.61)	164(70.39)	
Loss of appetite	Yes	158(45.27)	29(18.35)	129(81.65)	0.003
	No	191(54.73)	62(32.46)	129(67.54)	
Knowledge on malaria intervention methods					
	Yes	313(89.68)	70(22.36)	243(77.64)	<0.001
	No	36(10.32)	21(58.33)	15(41.67)	
Knowledge on IPTp					
	Yes	201(57.59)	28(13.93)	173(86.07)	<0.001
	No	84(24.07)	41(48.81)	43(51.19)	
	Don't know	64(18.34)	22(34.38)	42(65.63)	
Knowledge of malaria complication during pregnancy					
Abortion	Yes	115(32.95)	24(20.87)	91(79.13)	0.121
	No	234(67.05)	67(28.63)	167(71.37)	
Low Birth weight	Yes	125(35.82)	23(18.4)	102(81.6)	0.015
	No	224(64.18)	68(30.36)	156(69.64)	
Anemia	Yes	81(23.21)	10(12.35)	71(87.65)	0.001
	No	268(76.79)	81(30.22)	187(69.78)	
Premature deliveries	Yes	91(26.07)	14(15.38)	77(84.62)	0.007
	No	258(73.93)	77(29.84)	181(70.16)	

Ref- Reference group, OR- Odds ratio, CI-confidence interval. P value<0.05 was considered significant.

➤ *Factors Associated with Utilization of Malaria Preventive and Control Measure.*

As shown in **table 3**, participant's age influenced utilization of malaria preventive and control measures,. In persons Chi square analysis, participants of age group between 15-24 years were aware of malaria preventive and control measures and more likely to use them (p=0.038), In multivariate analysis, participants aged between 25-34yrs also were aware of malaria preventive and control measures and more likely to use the the disease intervention methods as compared to those above 35yrs (COD=1.9, 1.16-3.17 p=0.011). Other demographic factors ie, marital status, level of education and number of children were not statistically significant in this study.

Table 3 Demographic Factors Associated with Utilization of Malaria Preventive and Control Measures by the Participants

Variables	N(%)	Don't use Malaria Preventive and Control Measures n(%)	Use Malaria Preventive and Control Measures n(%)	Chi Pvalue	COR (95% CI)	P-value	AOR (95% CI)	P-value
Age group								
15-24 years	146(41.83)	48(32.88)	98(67.12)	0.038	Ref		Ref	
25-34 years	177(50.72)	36(20.34)	141(79.66)		1.92(1.16-3.17)	0.011	1.51(0.82-2.79)	0.190
35 and above	26(7.45)	7(26.92)	19(73.08)		1.33(0.3-3.37)	0.550	1.01(0.34-3.02)	0.979
Children								
No child	87(24.9)	30(34.48)	57(65.52)	0.227	Ref		Ref	
One child	133(38.1)	32(24.06)	101(75.94)		1.66(0.92-3.01)	0.094	1.67(0.86-3.24)	0.133
Two children	75(21.5)	17(22.67)	58(77.33)		1.8(0.89-3.61)	0.100	1.81(0.78-4.18)	0.168
Three and above children	54(15.5)	9(22.5)	31(77.5)		1.84(0.85-4.01)	0.124	2.14(0.81-5.61)	0.123
Tribe								
Missing	20(5.73)	7(35)	13(65)	0.743	Ref		Ref	
Kalenjin	6(1.72)	3(50)	3(50)		0.54(0.09-3.41)	0.511	0.27(0.04-1.87)	0.184
Kikuyu	5(1.43)	1(20)	4(80)		2.15(0.2-23.18)	0.527	2.50(0.2228.54)	0.462
Kisii	16(4.58)	3(18.75)	13(81.25)		2.33(0.49-11.06)	0.286	1.83(0.35-9.70)	0.476
Luhya	40(11.46)	8(20)	32(80)		2.15(0.65-7.16)	0.211	1.58(0.44-5.63)	0.484
Luo	249(71.35)	66(26.51)	183(73.49)		1.49(0.57-3.9)	0.414	1.24(0.44-3.52)	0.688
Maasai	2(0.57)	1(50)	1(50)		0.54(0.03-9.99)	0.678	0.73(0.0315.36)	0.838
Muganda	3(0.86)	0(0)	3(100)		1		1	
Other	7(2.01)	2(28.57)	5(71.43)		1.35(0.21-8.82)	0.757	0.77(0.10-5.76)	0.798
Kamba	1(0.29)	0(0)	1(100)		1		1	
Marital status								
Married	292(83.67)	73(25.00)	219(75.00)	0.301	Ref		Ref	
Single	57(16.33)	18(31.58)	39(68.42)		0.72(0.39-1.34)	0.302	0.96(0.47-1.96)	0.903
Religion								
Christianity	334(95.7)	88(26.35)	246(73.65)	0.584	Ref		Ref	
Muslim	15(4.3)	3(20)	12(80)		1.43(0.39-5.19)	0.586	1.58(0.37-6.69)	0.534
Level of education								
Primary	60(17.19)	19(31.67)	41(68.33)	0.114	1.18(0.58-3.66)	0.778	1.19(0.36-3.90)	0.771
Secondary	140(40.11)	41(29.29)	99(70.71)		1.32(0.46-3.80)	0.610	2.65(0.52-4.87)	0.420
College/uni versity	132(37.82)	25(18.94)	107(81.06)		2.33(0.79-6.91)	0.126	3.05(0.96-9.64)	0.058
None	17(4.87)	6(35.29)	11(64.71)		Ref		Ref	

Ref- Reference group, OR- Odds ratio, CI-confidence interval. P value<0.05 was considered significant.

➤ *Economic Factors*

As shown in **table 4**, majority 244 (73.49%) of the respondents used malaria preventive and control measures, 90 (25.79%) were employed of which 75 (83.33%) had greater knowledge and used disease preventive and control measures. 26 (96.3%) of the participants had permanent jobs and 76 (76.0 %) engaged in business. In persons Chi square analysis, the study findings reported statistical significant association on use of malaria intervention methods by the participants with employment

status and type of work with p values of 0.018 and 0.028 respectively. Those who were employed were more likely to use malaria preventive and control measures as compared to the unemployed (COR=2.08, CI=1.12-3.84, P=0.02). Participants who were in contract basis and casual workers were less likely to utilize malaria preventive and control measures as compared to those at permanent, with a significant association of (COR=0.09, CI=0.01-0.74, P=0.025) and (COR=0.11, CI=0.01-0.99, P=0.049) respectively. In the multivariate logistic regression model, type of work was a significant factor associated with use of malaria preventive and control measures. Those on contract basis had reduced odds of using malaria preventive and control measures (AOR=0.5, CI=0.0-0.73, P=0.028).

Table 4 Economic Factors Associated with Utilization of Malaria Preventive and Control Measures by the Participants

Variables	N(%)	Don't use Malaria Preventive and Control Measures n(%)	Use Malaria Preventive and Control Measures n(%)	Chi-Pvalue	COR (95% CI)	P-value	AOR (95% CI)	P-value
Residence								
Yes	332(95.13)	88(26.51)	244(73.49)	0.417	Ref		Ref	
No	17(4.87)	3(17.65)	14(82.35)		1.68(0.47-6.00)	0.422	3.09(0.16-59.72)	0.456
Period of Stay								
Less than 6 years	272(77.94)	69(25.37)	203(74.63)	0.731	Ref		Ref	
6-10 years	45(12.89)	11(24.44)	34(75.56)		1.05(0.5-2.19)	0.895	5.04(0.14184.41)	0.379
11-20 years	17(4.87)	6(35.29)	11(64.71)		0.62(0.22-1.75)	0.369	0.06(0-1.13)	0.06
Above 20 years	15(4.3)	5(33.33)	10(66.67)		0.68(0.22-2.06)	0.495	0.65(0.03-15.36)	0.789
Employment Status								
Yes	90(25.79)	15(16.67)	75(83.33)	0.018	2.08(1.12-3.84)	0.02		N/A
No	259(74.21)	76(29.34)	183(70.66)		Ref			N/A
Type of Work								
Permanent	27(30)	1(3.7)	26(96.3)	0.028	Ref		Ref	
Contract basis	40(44.44)	12(30)	28(70)		0.09(0.01-0.74)	0.025	0.05(0-0.73)	0.028
Casual worker	23(25.56)	6(26.09)	17(73.91)		0.11(0.01-0.99)	0.049	0.14(0.01-3.49)	0.229
Other engagements								
Student	25(9.65)	7(28)	18(72)	0.762	Ref			
Business	100(38.61)	24(24)	76(76)		1.23(0.46-3.3)	0.679		N/A
Farmer	43(16.60)	14(32.56)	29(67.44)		0.81(0.27-2.38)	0.695		N/A
Housewife	62(23.94)	17(27.42)	45(72.58)		1.03(0.37-2.9)	0.956		N/A
Hustler	29(11.2)	10(34.48)	19(65.52)		0.74(0.23-2.36)	0.61		N/A

Ref- Reference group, OR- Odds ratio, CI-confidence interval. P value<0.05 was considered significant.

➤ Sources of Information About the Disease and its Intervention Methods by the Respondents.

As shown in table 5, health talks by health workers during antenatal clinic in hospitals and health centres was a major source of information about the disease. The information was statistically significant and increased up take of malaria preventive and control methods by the pregnant women (p=0.001). In chi square test, the use of malaria interventions were statistically significant as follows. ITNs (p= 0.002), IPTp (p=0.016), IRS (p =0.01) taking drugs regularly (p =0.021). Other sources of information about the disease i.e school education, television family members, friends and colleagues were not statistically significant in this study.

Table 5 Sources of Information About the Disease and it's Intervention Methods

Variables	N(%)	Don't use Malaria Preventive and Control Measures n(%)	Use Malaria Preventive and Control Measures n(%)	P-Value
School/education				
Yes	151(43.27)	41(27.15)	110(72.85)	0.689
No	198(56.73)	50(25.25)	148(74.75)	
Hospital/clinic/health center				
Yes	214(61.32)	42(19.63)	172(80.37)	0.001
No	135(38.68)	49(36.3)	86(63.7)	
Family member				
V Yes	27(7.74)	6(22.22)	21(77.78)	0.635
No	322(92.26)	85(26.4)	237(73.6)	
Television/radio				
Yes	51(14.61)	9(17.65)	42(82.35)	0.138
No	298(85.39)	82(27.52)	216(72.48)	
Friends/Colleagues				
Yes	24(6.88)	4(16.67)	20(83.33)	0.277
No	325(93.12)	87(26.77)	238(73.23)	
Malaria Intervention methods				
Use of mosquito nets (ITNs)				
Yes	311(89.11)	73(23.47)	238(76.53)	0.002
No	38(10.89)	18(47.37)	20(52.63)	
Intermittent preventive measures (IPTp)				
Yes	112(32.09)	20(17.86)	92(82.14)	0.016
No	237(67.91)	71(29.96)	166(70.04)	
Indoor residual spraying (IRS)				
Yes	89(25.5)	14(15.73)	75(84.27)	0.01
No	260(74.5)	77(29.62)	183(70.38)	
Taking drugs regularly				
Yes	43(12.32)	5(11.63)	38(88.37)	0.021
No	306(87.68)	86(28.1)	220(71.9)	

Ref- Reference group, OR- Odds ratio, CI-confidence interval. P value<0.05 was considered significant.

➤ *Respondents WHO Ever Suffered from Malaria, Place of Treatment and Drugs Taken*

Majority 321 (91.98%) of the respondents agreed to have suffered from malaria while 28 (8.02%) declined as shown in table 6 and (fig 1).306 (95.33%) who suffered from the disease got help from the hospitals, 12 (3.74%) bought medication from the pharmacy, 2 (0.62%) took traditional herbs while 1 (0.31%) sorted for prayers (table 7). Coartem was the main medicine for malaria treatment as recorded by 187 (69.52%) of the respondents, 42 (15.61%) took Antipyretic/panadol, quinine was taken by 20 (7.43%) while 13 (4.83%) took SP. Only 2 (0.74%) respondents said to have taken CQ while 5 (1.86%) took other medicines which they could not remember (table table 8)

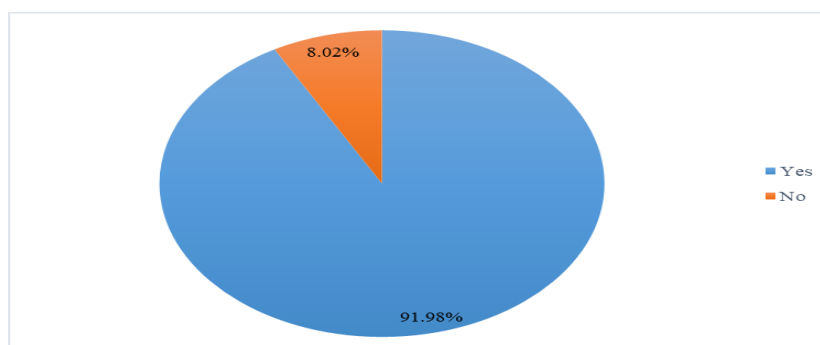


Fig 1 Participants WHO Ever Suffered from Malaria.

Table 6 Participants WHO Ever Suffered from Malaria

Ever suffered from malaria	Frequency (N)	Percent (%)
Yes	321	91.98
No	28	8.02
Total	349	100

Table 7 Place of Treatment

Source of help	Frequency (N)	Percent (%)
Hospital	306	95.33
Pharmacy	12	3.74
Praying	1	0.31
Traditional herbs	2	0.62
Total	321	100

Table 8 Type of Medicine Taken

Medicine type	Frequency (N)	Percent (%)
SP	13	4.83
Coartem	187	69.52
Quinine	20	7.43
CQ	2	0.74
Antipyretic/Panadol	42	15.61
Others	5	1.86
Total	349	100

IV. DISCUSSION

This study aimed at determining participant's knowledge on malaria, and socio-economic and demographic factors that were associated with utilization of malaria control and preventive measures in Kisumu city, lake Victoria region which is malaria endemic zone with prevalence of 28% (Jenkins, Omollo et al. 2015). Lake region remains at a high-risk of malaria infections with more efforts required by the ministry of health in employing control and preventive measures in the endemic regions for elimination strategies (Idris *et al.*, 2016). Knowledge and use of malaria preventive and control measures among pregnant women at antenatal care clinic are very important factors which targets malaria elimination (Akaba, Otubu et al. 2013). This study assessed disease knowledge, transmission, signs/symptoms, intervention methods, impacts/complications, socio-economic and demographic factors that influenced the use of malaria control and intervention methods by the pregnant women in Kisumu city.

The study findings reported that a greater percentage of the respondents had knowledge on disease transmission and transmission occurs through a bite from infected female anopheles mosquitoes, this is consistent with other studies which revealed that most of the respondents had knowledge on mosquito as a vector transmitting malaria disease (Baker 2010, Shimaponda-Mataa, Tembo-Mwase et al. 2017). The findings further reported association on disease transmission with use of malaria intervention methods, respondents who had knowledge on disease, it's mode of transmission were more likely to use malaria prevention and control measures, this is consistent with a study done in South Africa which reported that knowledge was a factor for the acceptance and use of malaria control tools by the community (Munzhedzi, McQuade et al. 2021).

Study findings further revealed that a small percentage of the respondents were not aware of the disease transmission method and reported that it occurs through contact or use of dirty water, this is worrying as infected mosquito bites to this group would cause further transmission and increase disease prevalence (Baker 2010).

The findings from this study reported that a greater percentage of the respondents had knowledge of major signs and symptoms of the disease. Fever/sweating, sour/ bitter taste in the mouth, headache, body ache, and loss of appetite were major signs as reported by the respondents, the result is consistent with a study done in Nigeria which reported the same signs and symptoms and included dizziness being one of the major signs of malaria in pregnancy experienced by the participants (Chukwurah, Idowu et al. 2016). This finding further revealed that knowledge on signs and symptoms of the disease was significantly associated with utilization of malaria preventive and control measures the study participant and statically significant, participants who had knowledge of signs and symptoms of the disease were more likely to use malaria preventive and control measures as compared to those who did not have this knowledge. The finding is consistent with a study done in South Africa which reported that women who had knowledge on signs and symptoms of malaria were likely to use malaria preventive measures (Munzhedzi, McQuade et al. 2021).

This study reported malaria intervention methods known by the respondents as, intermittent preventive measures (IPTp), indoor residual spraying (IRS) and taking drugs regularly, the findings is consistent with a study done in Nigeria which reported that IPTp and ITNs were the major known malaria intervention methods by the pregnant women (Akaba, Otubu et al. 2013). The findings revealed that the utilization of these intervention methods by the

respondents was below average as per the WHO recommendations (Muhumuza, Namuhani et al. 2016). Findings reported that the use of disease intervention methods were statistically significant and were associated with participant's knowledge, this finding is consistent with a study done in Nigeria and Ethiopia on use of ITNs by pregnant women, the findings reported that women's knowledge on malaria was significantly associated with ownership and use of ITNs (Adebayo, Akinyemi et al. 2015). The finding also concurs with another study done in Uganda which reported that the use of ITNs was associated with knowledge and level of education by the respondents. Another study reported significant association in knowledge and use of malaria intervention methods i.e use of antimalarial drugs for treatment and use of IPTp during pregnancy (Muhumuza, Namuhani et al. 2016). Many studies have documented the fact that women from poor households are less likely to receive distributed IPTp and ITNs due to lack of knowledge or because they are expensive (Roman, Wallon et al. 2014, Aberese-Ako, Magnussen et al. 2019). Another study reported that knowledge on period of high incidences of malaria and frequent malaria attack to the most vulnerable groups, pregnant women and children under five compels people to use disease intervention methods (Moukéné, Beakgoubé et al. 2021). The findings further reported that other malaria intervention method i.e., mosquito coils/ repellants and cleaning of environment as practiced by the study respondents were not statistically significant in this study.

The findings revealed an association between malaria complications during pregnancy with knowledge and use of malaria preventive /control measures. and reported that low birth weight, premature deliveries and anemia were malaria complications during pregnancy. Low birth weight, anemia and premature delivery were statistically significant in this study, this finding is consistent with other studies which reported the same as health associated problems/complications encountered by pregnant mothers during their pregnancies (González, Desai et al. 2014, Desai, Gutman et al. 2015, Kapisi, Kakuru et al. 2017).

This study assessed economic and demographic factors that were associated with utilization of malaria prevention and control measures by the pregnant women. The findings reported that participant's age and number of children were determining factors in the use of malaria prevention and control measures. The findings revealed an association between use of malaria preventive/control measures in age group below 20yrs, this is contrary with a study done in Senegal which reported that young adolescent women were shy from inquiring prior knowledge on pregnancy and less likely to utilize malaria intervention methods during their pregnancies. (Mbengue, Bei et al. 2017). The findings further reported that participants of age group between 31 to 35 years were more likely to utilize malaria preventive and control measures as compared to age group below 20yrs of age, this finding is consistent with a study done in Nigeria which reported that pregnant women between 31-35yrs had a lot of experience and were aware of utilization of malaria interventions as compared to the rest of the

groups (Auta 2012, Iyanda, Osayomi et al. 2020). The findings also concurs with a study done in Senegal which reported that older women of age 35-49 years had more knowledge and experience on the use of malaria preventive method during pregnancy (Mbengue, Bei et al. 2017). The findings further revealed that respondents with two children had increased odds of using malaria preventive and control measures compared to those with no children, this finding is consistent with a study done in Nigeria which reported that women with 4 children and above had a lot of experience in the use of malaria preventive and control measures (Iyanda, Osayomi et al. 2020). This study did not report any statistical significance in marital status, tribe, and religion with the use of malaria interventions by the respondents, but observed that 100% of divorcees and greater percentage of married respondents were aware of malaria preventive and control interventions.

This study revealed influence of economic factors on the respondents in different ways, including the finding that most of the respondents with college /university education were aware of malaria preventive and control measures. This study, surprisingly, did not report any statistical significant association with education and utilization of malaria preventive measures which is contrary to other study findings done in different parts of the world which have reported education as a key factor in promoting knowledge (Hill, Hoyt et al. 2013, Tobin-West and Kanu 2016). Other studies done in Zambia and Bangladesh reported that level of education and poverty were some of the factors that affected knowledge on malaria preventive and control measures by the pregnant women (Ahmed, Haque et al. 2009, Shimaponda-Mataa, Tembo-Mwase et al. 2017). Another study done in Nigeria and Ghana reported that education positively affected participants choice on malaria treatment (Erhun, Agbani et al. 2005, Dako-Gyeke and Kofie 2015, Iyanda, Osayomi et al. 2020).

This study reported a positive association on employment status and type of work as factors significantly associated with utilization of malaria preventive and control measures by the respondents, those who were employed were more likely to utilize malaria preventive and control measures as compared to those not employed. This finding is consistent with a study done in Nigeria which reported that women who are employed were more likely to use malaria preventive and control measures (Aregbeshola and Khan 2018). There was a statistical significance on type of work with utilization of malaria preventive and control measures by the respondents, those who were in contract basis and casual workers were less likely to utilize malaria preventive and control measures as compared to permanently employed individuals. The result is consistent with a study done in Kenya, which reported that type of work significantly affects utilization of disease interventions methods (Ng'ang'a, Aduogo et al. 2021). The study findings further revealed that a bigger percentage of the respondents who had stayed in the study area for less than 6 years, not employed and had some other engagements were all aware of malaria preventive and control measures. It further reported that period of stay in the study area, and other

economic engagements were not statistically significant in relation to the use of malaria preventive and control measured by the study respondents.

This study reported that majority of the respondents have ever suffered from malaria and got treatment from the hospitals, while a few of the respondents bought drugs from the pharmacy, took traditional herbs and others sorted for prayers when they had malaria. The finding further reported that coartem was the main medicine taken by most of the respondents when they had malaria, This finding is consistent with a study done on malaria treatment which reported that artemisinin (AL) is safe to use during second/ third trimester and reduces malaria related complication during pregnancy (Achan, Talisuna et al. 2011, Organization 2015). Other respondents took antipyretic (paracetamol), quinine, septrin®, and chloroquine for malaria treatment.

In summary, study findings reported that a greater number of the respondents had knowledge on disease signs and symptoms., and complications involved during pregnancy. Knowledge of ITN as malaria intervention method was above average, however, IPTp knowledge and uptake was below average. Health facilities were the mains source of information about the disease. Pregnant women's knowledge on disease influenced utilization of its intervention methods by the respondents. Socio-economic factors i.e., participant's employment status and type of work influenced utilization of malaria intervention methods. Education as an economic factor did not was too significant in this study. Demographic factors like age and number of children also influenced the use of disease intervention method by the respondents.

V. CONCLUSION

The data from this study has shown risk of malaria in pregnant women within Kisumu city is high. The findings reported knowledge on disease transmission, signs and symptoms, sources of information and complications involved during pregnancy affected utilization of malaria preventive and control measures by the respondents. A bigger proportion of the respondents had knowledge on malaria intervention methods, use of IPTp as malaria intervention method was low. However, knowledge and use of Coartem® as antimalarial was high by the respondents. The finding also reported that socioeconomic factors influenced the utilization of malaria preventive and measures by the respondents. Demographic factors of the participants influenced utilization of malaria preventive and control measures by the respondents.

RECOMMENDATIONS FOR ACTIONS

➤ *The Following Recommendations for Action were Made Based on the Findings of this Study.*

- There is need for proper community engagement in health education through local chiefs and community health volunteers, to increase awareness and uptake of disease interventions.

- More effort is required by the government to provide free malaria control and prevention measures and increase awareness to the community.
- Health care workers should give intensive health education to pregnant women at ANC in order know the importance on uptake of the recommended doses of IPTp during pregnancy

➤ *Recommendations for Future Actions.*

The following recommendations for future actions were made based on the findings of this study

- There is need for a longitudinal study to monitor the uptake of malaria intervention by the pregnant women. Such a study should be done with an increased sample size to evaluate the current study findings. It should in addition evaluate the challenges faced by the pregnant women at ANC platform on uptake of the disease interventions.

➤ *Abbreviations and Acronyms*

- PMI - President's Malaria Initiative; ACTs - Artemisinin-based Combination Therapies; OPD - Out Patient Department
- SP - Sulfadoxine Pyrimethamine; CRFs - Case Report Forms; IRS - Indoor Residual Spraying; IPT - Intermittent Preventive Treatment
- IPTp - Intermittent Preventive Treatment prophylaxis; IVM - Integrated Vector Management; WHO - World Health Organization
- TBAs - Traditional Birth Attendants; DHS - Demographic and Health Survey ;USAID - United States Agency for International Develo
- Pment; KNMS - Kenya National Malaria Control ; MIP - Malaria In Pregnancy ; KNBS - Kenya National Bureau of Statistics
- KMS - Kenya Malaria Strategy; NMCP - National Malaria Control Program; SBCC - Social and Behavioral Change

➤ *Communication*

- SP - Sulfadoxine-Pyrimethamine; ANC- Antenatal Care ITN- Insecticide Treated Nets, MOH- Ministry of Health.
- Authors' contribution
- Esther odongo,Asito Stephen Amollo, Fred Amimo and Irene Okwaro, participated in the inceptionand design of the study,Esther Odongo and Caroline Atieno; conducted field work and data collection. Mudis Ogutu Kai helped in data entry and data analysis Esther Odongo, wrote first draft of the manuscript, Asito Stephen Amollo Fred Amimo and Irene Okwaro reviewed the draft of the manuscript. Esther odongo, Asito Stephen Amollo and Fred Amimo, read and approved the final copy of the manuscript.

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➤ *Availability of Data and Materilas*

The use of informed consent form and data security provided during the study guaranteed limited access to the data base

➤ *Ethical Approval and Consent to Participate*

The research was carried out in accordance with the ethical principles as defined in the guidance for Good Clinical Practice and the Principles as outlined in the Declaration of HIsinki (Williams 2008). A letter of University approval was obtained from Jaramogi Oginga Odinga University of Science Technology from the office of the director, department of post graduate (see appendix iii) Ethical approval no IERC/JOOTRH/319/20 (see appendix iv) was obtained from Jaramogi Oginga Odinga Teaching Refferal Hospital Institutional Ethical Review Committee, Kisumu County approval was obtained from department of health and sanitation, office of the county director of public health (see appendix v) and approval of data collection from KCRH facility was obtained from the medical supretandant and Nursing officer from KCRH hospital. (see appendix vi). All study participants who signed consent form voluntarily took part in the study and were informed that they could drop out of the study at their own will. Anonymity was maintained as subjects' identifiers were protected. Privacy of results was ensured, and study participants were assured that there was no harm in participating in the study.

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APPENDIX I : INFORMED CONSENT FORM

Due to of COVID 19 situation in the country, all of us need to observe infection prevention control measures and need to follow the regulations from the ministry of health in order to prevent the disease from infecting us. Am therefore requesting you to always follow these rules, correctly put on your mask before and after this procedure and sanitise as frequent as you can.

Malaria is serious infections and a common cause of anemia (lack of blood) in pregnancy and can result in loss of the pregnancy, low birth weight and preterm deliveries. Sometimes you may have malaria infection without feeling sick. The area you are coming from (Kisumu town) is one of the malaria endemic areas and many people have frequent malaria attacks.

To help prevent malaria, the Government of Kenya has put policies on malaria control strategies and rolled out malaria interventions to reduce malaria infection especially to pregnant women and children under 5 years of age but this has not effectively worked out as the disease prevalence is still high at 28% in the county. We want do a research to determine the knowledge level of malaria and socio economic factors associated with utilization of malaria control and prevention measures by the pregnant women in the Kisumu city and identify any existing gaps. This is an individual project and no one except the principal researcher and research assistants will have access to the raw information on your questionnaire. You will be asked some questions about cause of malaria including signs and symptoms, malaria intervention methods that you are using and some factors that could be hindering you from using the available intervention methods. We will also be asked questions about your age, level of education, marital status source of income and religion. You will be required to answer all these questions but you will not be forced / penalized for not answering all the questions. You may choose not to answer any question or stop at any time if you wish. You will not be followed up or asked to come for any visit for further data collection during the study.

There will be no any risk involved in this study and no samples will be taken from you. Refusing to participate in this study will not stop you from receiving routine health care services in any health facilities. You will come for your normal ANC clinics as usual and visit any health facility whenever you are sick. You will not be paid for participating in the survey, however the information that we will receive from you will help us know whether pregnant women are aware of the malaria, its interventions methods, identify all challenges in using interventions and any existing gap/s that need to be addressed. The information that will be received from this study will help the policy makers in making informed decision and give their recommendations to the county.

All these processes will take between 10 to 15 minutes. If you have any questions or concerns about participation, please contact the researcher: Esther Odongo Phone No 0720 175 120 / 0780 175 120. If you agree to participant, then you will be expected to sign this consent form, and if you are not able to read and write, you will asked to look for a witness who will be in the consenting process, sign the form on your behalf and you will be expected to put your thump prints before data any collection knowledge and social economic factors associated with utilization of malaria preventive / control measures among pregnant women in Kisumu city.

Interview date-----/-----/-----	Facility Name-----		Form number-----
Participants Information Study ID/Number----- Age-----/yrs.	Sign if you agree to participate in the study Participants signature -----		Date -----/-----/20-----
Witness Information Name----- Age-----yrs.	Witness's signature -----	Participants thump print	Date -----/-----/20-----
Assistant Research Officer Name-----	Signature -----		Date -----/-----/20-----
Reviewer Name-----	Signature -----		Date -----/-----/20-----
Data clerk Name-----	Signature -----		Date -----/-----/20-----

Appendix II : A Questioner On

- *Are you Staying within the Town (Study Area)?*
 - a = Yes
 - b = No
- *If yes, for how Long have you Stayed in your Place of Residence?.....*
- *What is your Ethnic Group/Tribe?*
- *How Old are you?.....*
- *What is your Marital Status?*
 - a = Married
 - b = Single
 - c = Divorced
 - d = Widowed
- *Which Religion do you Belong to?.....*
- *What is your Level of Education*
 - a = Texiary/College
 - b = Secondary
 - c = Primary
 - d = None
- *Are you Employed?*
 - a = Yes
 - b = No
- *If yes, what Type of Work do you do?*
 - a = permanent
 - b = Contract basis
 - c = Casual worker
- *If No, what are you doing.....*
- *How many children do you have?.....*
- *Do you have any Knowledge on Impact of Malaria in Pregnancy*
 - a = Yes
 - b = No
- *If yes, what are Some Complications Involved when you have Malaria in Pregnancy?*
 - a = Abortion
 - b = Low birth weight
 - c = Anaemia
 - d = Premature deliveries
 - f = Others (mention all)
- *Do you have any Knowledge on Malaria Transmission?*
 - a = Mosquito bite
 - b = Dirty rainy water
 - c = Dirty food

➤ *Do you have any knowledge on Signs and Symptoms of Malaria?*

- a = Yes
- b = No

➤ *If yes, can you Mention Them:*

- a = Headache
- b = Vomiting/ Nausea
- c = Body ache
- e = Stomach ache
- f = Sweating / fever
- g = Sour/bitter taste in the mouth
- h = Loss of appetite
- i = Others (mention all)

➤ *Do you have any Knowledge of Malaria Intervention Methods?*

- a = Yes
- b = No

➤ *If yes, where did you Get this Information from?*

- a = School/education
- b = Hospital/clinic/health centre
- c = Family member
- d = Television/radio
- e = Friends/colleague
- f = Others (mention all)

➤ *Can you Mention Malaria Intervention Methods that you Know?*

- a = Use of mosquito bed nets (ITNs)
- b = Intermittent preventive treatment (IPTp)
- c = Indoor residual spraying (IRS)
- d = Use of insect repellents
- e = Clean environment
- f = Taking drugs regularly
- g = Others (mention all)

➤ *Have you Ever Suffered from Malaria?*

- a = Yes
- b = No

➤ *If yes, where did you Get Help from?*

- a = Hospital
- b = Pharmacy
- c = Praying
- d = Witch doctor/ a traditional healer
- e = Traditional herbs

➤ *Did you Take any Medicine when you Suspected that you had Malaria?*

- a = Yes
- b = No

➤ *If yes, what Medicine did you Take?*

- a = SP
- b = Coartem
- c = Quinine
- d = CQ
- e = Antipyretic/Panadol
- f = Septin

➤ *Do you have any Knowledge on IPTp in Pregnancy*

- a = Yes
- b = No
- c = Don't know

➤ *If yes, what is it Used =for?*

- a= malaria treatment
- b=treatment of other diseases
- c= mention all

➤ *Do you have Itns that you Use when Sleeping?*

- a=Yes
- b=No

➤ *If yes for Question 24, 25 and 26, what are Some of the Factors Hindering you from Utilization of Malaria Preventive and Control Methods (IPTP/ Itns / Antimalarial)*

- a = Expensive
- b = Not aware of the interventions
- c = ITNs / antimalrials not available
- e = Nets not comfortable (heat, irritation e.t.c)
- f = Health facilities very far
- g = No proper health talk by the health workers
- h = Perception of malaria by the pregnant women
- I = Mention others

➤ *Do you have any Suggestion that you can Add in Relation to Control of Malaria in the Town?*

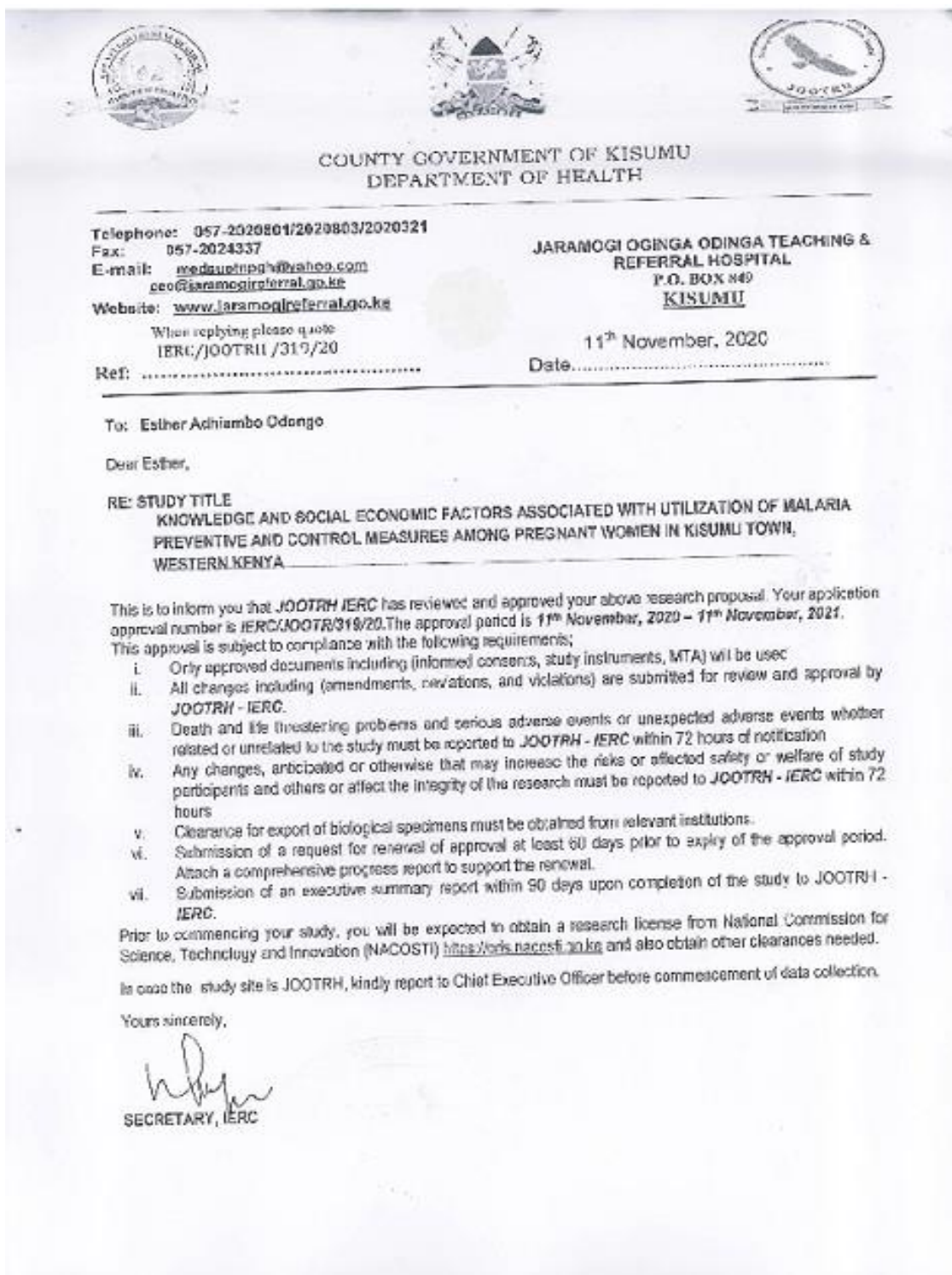
- a = Yes
- b = No

➤ *If yes, Mention all*

- a
- b
- c
- d
- e

➤ *Thank you for Taking your Time and Participating in this Study*

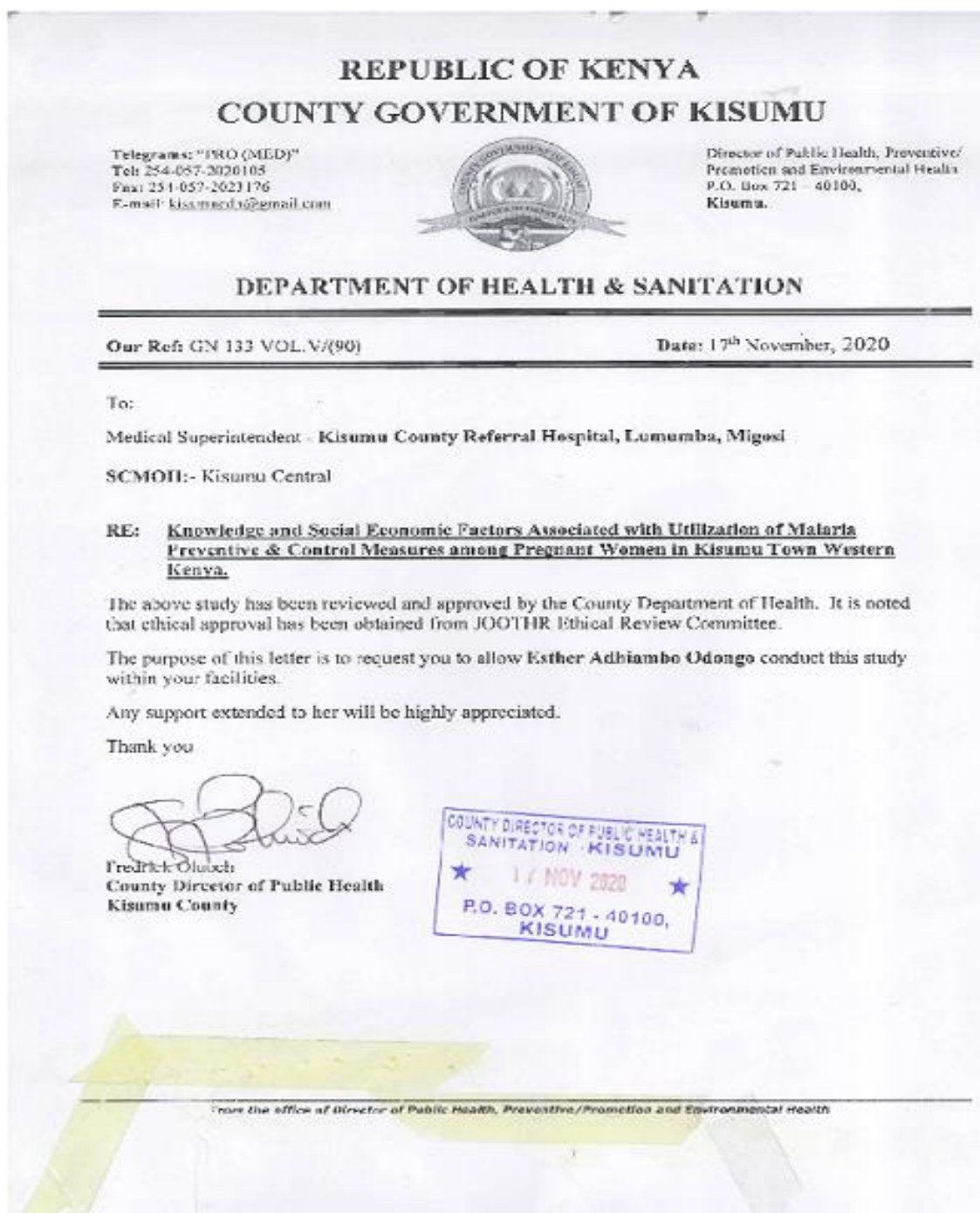
APPENDIX III ETHICAL APPROVAL



APPENDIX IV UNIVERSITY APPROVAL



APPENDIX V: COUNTY GOVERNMENT APPROVAL



APPENDIX VI KCRH (HOSPITAL) APPROVAL

