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Factors influencing utilization of insecticide-treated mosquito nets among women in the third trimester of pregnancy at Kiryandongo Hospital, Uganda

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ABSTRACT

Malaria is a life-taking parasitic infection transmitted by an infected female anopheles mosquito. Pregnancy-associated malaria infection has deleterious effects on maternal, fetal, and infant health. Despite the fact that insecticide-treated mosquito nets (ITNs) have been widely made accessible to the population, especially in rural area health centers where free ITNs are distributed to mothers attending antenatal care, malaria in Uganda continues to be a major cause of morbidity and mortality in pregnancy especially in the third trimester. This study seeks to find out the factors influencing the utilization of insecticide-treated mosquito nets among women in the third trimester of pregnancy at Kiryandongo Hospital, Kiryandongo District. This study was cross-sectional. A total of 221 women in their third trimester of pregnancy seeking medical care at KiryandongoGeneral Hospital were sampled. From the result, the ownership (72%) and use (sleeping under)-43.5% of insecticide mosquito nets among women in their third trimester of pregnancy at Kiryandongo Hospital was higher than that of other target groups. The study revealed that socio-demographic factors including occupational status, educational level, income level, distance to the ANC unit, and previous history of malaria cases were associated with higher ownership and use of ITNs. In the study,we may also conclude that knowledge of the use of ITNs including knowing the importance of ITNs in preventing bites from infected mosquitos, and when to have the mosquito nets tucked in under the bed was associated with higher usage of ITNs among the respondents. The source of mosquito nets also mattered in the ownership and use of the mosquito nets.

Keywords: Malaria, mosquito, pregnant women, antenatal care, insecticide-treated mosquito.

INTRODUCTION

Malaria is a life-taking parasitic infection transmitted by an infected female anopheles mosquito with very high morbidity, socio-economic, and social impact [1-3]. Malaria remains a major concern during all the trimesters of pregnancy and it remains a major cause of miscarriages, premature birth, and low birth weight [4, 5]. Sub-Saharan Africa, South East-Asia, America, Pacific, and Eastern Mediterranean regions report high cases and deaths due tothe infection [2, 3, 6]. Several groups; including infants, under-five children, pregnant mothers, and people living with HIV/AIDS as well as mobile populations including travelers are at a considerably higher risk of developing severe forms of malaria infection [7-9]. Sub-Saharan Africa faces challenges in the fight against malaria including large areas of transmission, limited control interventions, and restrained infrastructures for disease monitoring [10, 11]. In the majority of countries, poor political will by governments and other socioeconomic factors like poverty and illiteracy have hindered the goals of malaria eradication and strategic control interventions [1].

Pregnancy-associated malaria infection on maternal, fetal, and infant health is a global health concern [12, 13]. Malaria infection threatens over 25 million pregnancies each year with resultant 2- 15% of anemia during pregnancy, 30% of low birth weight, and 10% of all miscarriages [14-18]. Uganda contributes up to 5% of the global burden of malaria cases and is ranked 7th with the highest death (3%) [8, 19].

Vector control is proven a great scientific intervention in curtailing malaria infection today, and it stands as a considered means due to the lack of reliable vaccine, the emergence of resistant species, and socio-economic constraints of affording potent anti-malarial drugs [20]. Low-cost intervention strategies are already proven effective in the prevention and control of mosquitoes and these include the effective utilization of Insecticide Treated Nets (ITNs), Indoor Residual Spraying (IRS) [21]. Insecticide-treated nets are proven scientifically as an effective strategy to reduce malaria infections through a bite and also killing of mosquitoes. In-door residual spraying aims at killing mosquitoes that enter houses resting on sprayed surfaces, however, these major interventions have had a setback due to the emergence of insecticide resistance and community beliefs and the impacts on the environment as well as human health. [1].

Despite the fact that ITNs have been widely made accessible to the population, especially in rural area health centers where free ITNs are distributed to mothers attending antenatal care, malaria in Uganda continues to be a major cause of morbidity and mortality in pregnancy especially in the third trimester. The prevalence of malaria in pregnancy which is expected to decline has not yet been realized. Furthermore, studies have shown that despite ownership of ITNs, less than 17.4% sleep under treated mosquito nets [22, 23]. No data exists on the ownership and sleeping under treated mosquito nets among pregnant women in Kiryandongo, and it is on this background that this study seeks to find out the factors influencing the utilization of insecticide-treated mosquito nets among women in the third trimester of pregnancy at Kiryandongo Hospital, Kiryandongo District.

METHODOLOGY

Study Design

This study was cross-sectional

Study Area

The study was carried out in Kiryandongo General Hospital, Kiryandongo district

Study Population

The study targeted all pregnant women attending Kiryandongo General Hospital.

Selection Criteria

Only women in their third trimester of pregnancy seeking medical care at KiryandongoGeneral Hospital. All pregnant women that consent to participate in the study were included. The study excluded all post-natal & those in the first and second trimesters seeking medical careat Kiryandongo General Hospital. The study also excluded women who had miscarriages and present seeking medical care at Kiryandongo General Hospital.

Study Variables

The utilization of ITNs among pregnant women in the third trimester was the dependent variablein the study. The independent variables used in the study were: socio-demographic characteristics,individual and perceptions of the pregnant women that influence the utilization of ITNs.

Sample Size Determination

The study will use Kish and Leslie's (1973) formula to determine the sample size at a 95% confidence level, and proportion of mothers utilizing ITNs correctly and frequently at (17.4%) and an error margin of 5%

$$n = \frac{Z^2 p}{q}$$

Where n = sample size required
Z =Confidence level

$$e^2$$

P = Proportion of mothers sleeping under ITNs frequently [22].
E =Error Margin

$$n = \frac{1.96^2 x\ 0.174\ x\ (1 - 0.174)}{0.05^2}$$

$$n = \frac{3.8416x0.174x0.826}{0.0025}$$

n = 221 Respondents

Sampling Procedure and Data Collection Tools

Simple random sampling was used in the study. Interviewer-administered semi-structured questionnaires were used to collect data from the pregnant women attending Kiryandongo Hospital.

Data Management & Presentation

Following data collection from the study area, data was then entered into the computer for analysis using Statistical Package for Social Sciences (SPSS) V20. Data was then computed and presented in the form of univariate and bivariate analyses. Other data forms were presented as bar graphs or pie charts. Univariate data that was presented was descriptive statistics that show data in the form offrequency distribution tables, and percentages. Socio-demographic characteristics, individual factors, and perception were entered as Univariate descriptive statistics. In order to determine the association between dependent and independent variables, a Pearson Chi-Square analysis was done. The Chi-Square correlations of independent with a dependent variable that has a p-value of 0.05 were considered significantly important. This was attained by calculating the confidence interval at 95% and the probability value.

Ethical Consideration

An introductory letter was obtained from the Dean of the Faculty of Clinical Medicine and Dentistry KIU-WC and ethical approval for the study conduct was obtained from Kampala International University Institutional Research Ethics Committee. Verbal and written consent from the respondents was sought and they got assured 100% confidentiality for all the information dispensed by them. Participation of the respondents was completely voluntary without any bribery aids for further participation. Each eligible and selected pregnant mother was required to formally give written consent to the procedure of data collection. Maximum confidentiality was kept as the identity of the respondents remained anonymous and each respondent was free to withdraw from the processof data collection voluntarily without any legal implications.

RESULTS

A total of 221 women in their third trimester of pregnancy at Kiryandongo Hospital were sampled to determine the factors associated with the use of treated mosquito nets during pregnancy.

Age of the mother	< 24 years	70	32.3
	25-34 years	117	54.9
	>35 years	26	11.8
Marital status of the mother	Single	75	35.3
	Married/cohabiting	120	50.6
	Separated	20	6
	Widowed	9	4.1
Occupational status of the mother	Housewife	70	33.1
	Self-employed	80	51.2
	Formally employed	25	15.7
Highest level of education attained	No formal education	57	40.3
	Primary level	100	45.9
	Secondary level	28	13
	Tertiary/institutional Education	30	15.8
Approximate earning per	Depends on husband	130	60.7

month			
	<100,000	62	28.1
	100,001-300,000	22	9.3
	>300,001	26	11.8
	Walkable distance	88	38.6
Distance to the health facility	5-10km	105	46.6
	>10km	28	12.8
Number of pregnancies/children	First pregnancy	78	30.8
	second pregnancy	123	53.1
	>3 children/pregnancies	31	14
Previous diagnosis with malaria in current pregnancy	Once	46	20.8
	Twice	105	46.1
Number of ANC contactshad in the current pregnancy	>More than twice	65	27.8
	I don't know	23	13.4
	One	28	12.7
	Two	90	40.7
	three & above	103	47.6

Out of the 221 pregnant mothers, majority 54.9 % (117) were aged between 25-34 years, and were married 50.6 %(120), with 53.1%(123) had their second pregnancies. At least 45.9% (100) had attained primary level of education, although 50.7%(130) were depending on their husbands and only 28.1%(62) earned less than <300,000 Ugx monthly. Majority of the mothers also were residing within 5-10km 46.6(105), and the three quarters 47.6%(103) had made more than three ANC contacts.

Table 2: relationship between socio-demographic characteristics of respondents and sleeping under mosquitonets

Variable	*Category*	*Are you sleeping under your treated mosquito net*		*X*	*p-value*
		Yes	No	2.941	0.230
Age of the mother	< 24 years	29(37.2%)	49(62.8%)		
	25-34 years	56(47.9%)	61(52.1%)		
	>35 years	9(34.6%)	17(65.4%)		
Marital status of the mother	Single	27(40.3%)	40(59.7%)	0.837	0.841
	Married/cohabiting	54(43.2%)	71(56.8%)		
	Separated	8(40.0%)	12(60.0%)		
	Widowed	5(55.6%)	4(44.4%)		
Occupational status of the mother	House wife	66(53.2%)	58(46.8%)	13.968	***0.001**
	Self-employed	18(26.1%)	51(73.9%)		
	Formally employed	10(35.7%)	18(64.3%)		
Highest level of education attained	No formal education	24(35.8%)	43(64.2%)	12.307	***0.006**
	Primary level	35(36.1%)	62(63.9%)		
	Secondary level	21(67.7%)	10(32.3%)		
	Tertiary/institutional education	14(53.8%)	12(46.2%)		
Approximate earning per month	Depends on husband	51(45.5%)	61(54.5%)	8.038	***0.045**
	<100,000	31(50.0%)	31(50.0%)		
	100,001-300,000	4(19.0%)	17(81.0%)		
	>300,001	8(30.8%)	18(69.2%)		
Distance to the health facility	Walkable distance	48(52.2%)	44(47.8%0	8.732	***0.013**
	5-10km	33(32.0%)	70(68.0%)		
	>10km	13(50.0%)	13(50.0%)		

*Number of pregnancies/children	First pregnancy	32(41.6%)	45(58.4%)	3.687	0.158
	second pregnancy	44(38.9%)	69(61.1%)		
	>3 children/pregnancies	18(58.1%)	13(41.9%)		
Number of times mother was treated with malaria in the current pregnancy	Once	19(41.3%)	27(58.7%)	15.100	***0.000**
	Twice	42(39.3%)	65(60.7%)		
	>More than twice	33(48.5%)	35(51.5%)		

***denotes significant p-value <0.05**

Ownership & sleeping under mosquito nets among respondents

Ownership of mosquito nets among women in their third trimester of pregnancy at Kiryandongo Hospital

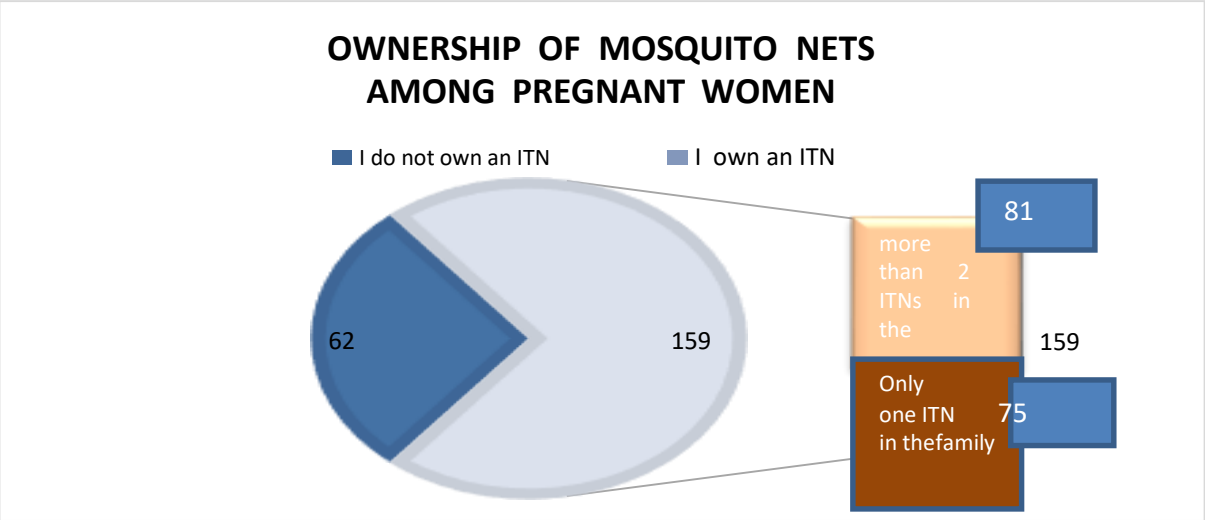

Figure 1: A pie chart and a bar graph showing ownership of ITNs among women in their thirdtrimester of pregnancy at Kiryandongo Hospital.

Out of the 221 sampled pregnant mothers, 75% owned an ITN, while 25% did not own an ITN. Out of the 75%, 81 had more than 2 ITNs in their families, while 75 had only one mosquito-treated net.

Source of ITNs for women in their third trimester of pregnancy at KiryandongoHospital

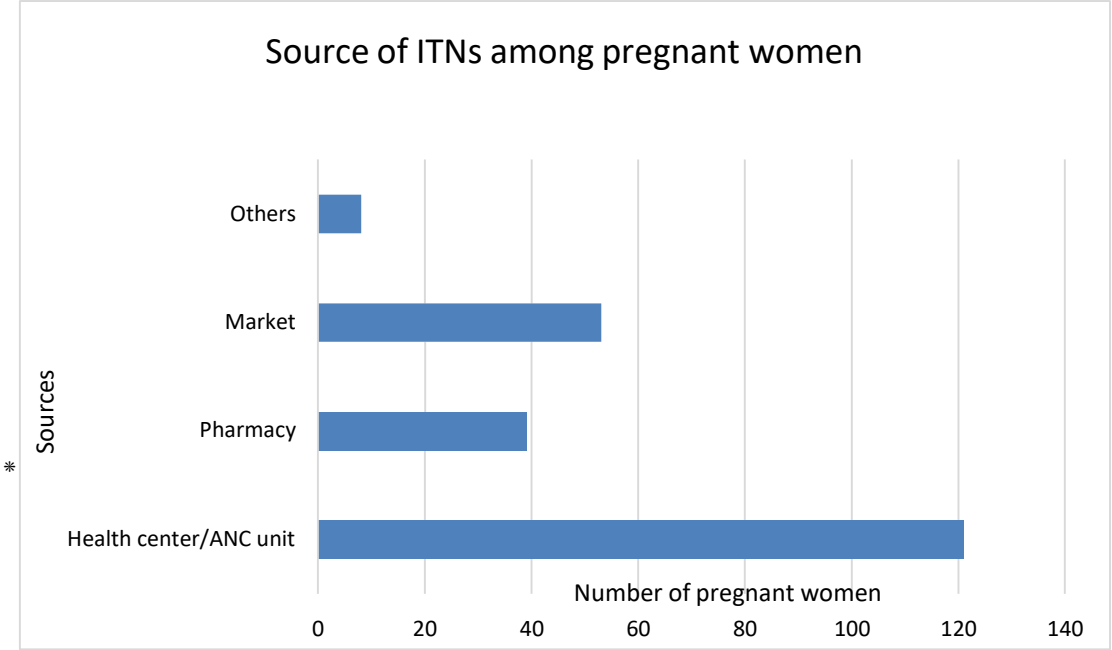

Figure 2: A bar graph showing source of ITNs for women in their third trimester ofpregnancy at Kiryandongo Hospital

Sleeping under ITNs for women in their third trimester of pregnancy at Kiryandongo Hospital

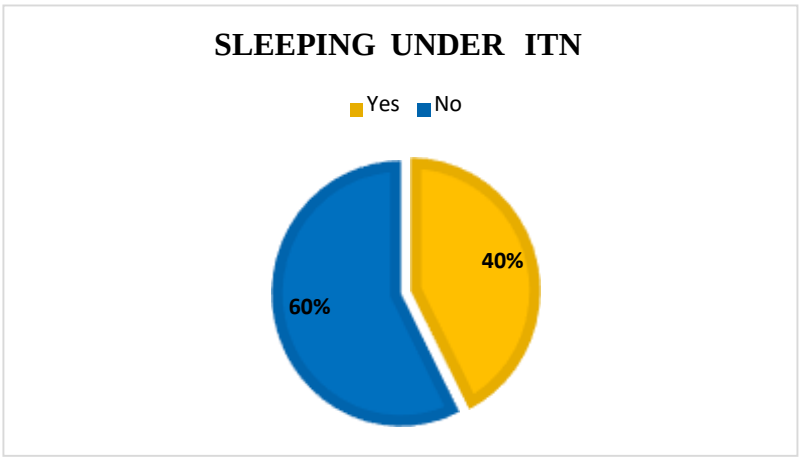

Figure 3: A pie chart showing proportion of women in their third trimester of pregnancy atKiryandongo Hospital sleeping under the treated mosquito nets

Knowledge of respondents regarding ITNS

TABLE 3: frequency distribution showing knowledge regarding ITNs and care

Variables	*Categories*	*Frequency*	*Percent*
Ever heard of Insecticide treated mosquito nets	Yes	170	78.2
	No	51	21.8
Are you sleeping under yourtreated mosquito net	Yes	94	42.5
How often do you wash your mosquito nets	No	127	57.5
	Usually	61	27.6
have you ever recycled your net for treating	Occasionally	136	61.5
	Never washed it	24	10.9
	Yes	22	10
How long have you had a mosquito net(s) at your home	No	35	15.8
	I burn my mosquito net after sometime	160	74.2
	Days	55	25.8
	Weeks	46	20.8

	Months	115	47.5
	Years	13	5.9
Do you always check for holes on your mosquito net(s)	Yes	70	30.2%
	No	18	8.3%
	Never thought of it	140	62.5%

Table 3 above revealed that majority 78.9 %(170) of the mothers had heard of insecticide mosquito nets, and 47.5% of the mothers had had their mosquito nets for months. However, only 10.0%(22) had recycled their mosquito nets for treating, while the majority 74.2%(160) burnt or disposed off their mosquito nets after wearing out or having many holes. From the study respondents, 61.5%(136) washed their mosquito nets occasionally, 27.6%(61) washed their mosquito nets usually. About 30.2% checked for holes in their mosquito nets, the rest never bothered to check for holes.

Table 4: Bivariate analysis of knowledge regarding ITNs and sleeping under the treatedmosquito nets

Variable	***Category***	***Are you sleeping under your treated mosquito net***		***X***	***p-value***
		Yes	No		
Ever heard of Insecticide treated mosquito nets	Yes	65(37.1%)	110(62.9%)	9.997	***0.002**
	No	29(63.0%)	17(37.0%)		
How long have you had a mosquito net(s) at your home	Days	23(40.4%)	34(59.6%)	1.590	0.662
	Weeks	17(37.0%)	29(63.0%)		
	Months	47(44.8%)	58(55.2%0		
	Years	7(53.8%)	6(46.2%)		
How often do you	Usually	22(36.1%0	39(63.9%)	9.151	***0.010**

wash your mosquito nets					
	Occasionally	55(40.4%)	81(59.6%)		
	Never washed it	17(70.8%)	7(29.2%)		
At what time do you have your mosquito net tucked-in on your bed?	When am entering the bed	46(41.8%)	64(58.2%)	13.370	***0..001**
	Immediately it turns dark	14(35.0%)	26(65.0%)		
	The time when mosquitos are many	34(47.9%0	37(52.1%0		
Source of mosquito treated mosquito net	health centre/ANC unit	59(48.8%0	62(51.2%)	4.298	0.231
	Pharmacy	14(35.5%)	25(64.1%)		
	Market	18(34.0%)	35(66.0%)		
	Others	3(37.5%)	5(62.5%)		
How long are nets supposed to be hanged out before use	12 hours	23(40.4%)	34(59.6%)	1.590	0.662
	24 hours	17(37.0%)	29(63.0%)		
	48 hours	47(44.8%)	58(55.2%)		

A bivariate analysis of knowledge factors regarding ITNS and its use revealed that mothers who had ever heard of insecticide mosquito nets $x^2 = 9.997$, $p - value$, 0.002, washed their mosquito nets $x^2 = 9.151$, $p - value$, 0.010, and also those who knew when to have their mosquito nets tucked in on their beds $x^2 = 13.370$, $p - value$, 0.001, were significantly associated with sleeping under the treated mosquito nets.

The duration that the mother had spent with the ITNs, and the source of the mosquito net were notsignificantly associated with sleeping under the ITNs with p-value >0.05

Perceptions regarding ITNs among respondents

TABLE 5: A frequency distribution table showing perceptions ofwomen in their third trimester of pregnancy at Kiryandongo hospital towards ITNs

Variable	*Category*	*Frequency (n=221)*	*Percent (100%)*

Do Insecticide treated mosquito nets preventmalaria transmission	Yes	172	77.4
	No	27	12.2
	I don't know	22	10.4
Ever heard of Insecticide treated mosquito nets	Yes	175	79.2
	No	40	20.8
Reason for not possessing a treated mosquito net	I never received one	47	66.1
	Expensive	7	11.3
	destroyed	14	22.6
	Total	***n=62(had no ITN)**	
Reason for possessing mosquito net, but not sleeping under the net	I feel itchy after sleeping under the net	92	59.5
	Poor quality nets	18	11.3
	Not enough information received on use of the nets	33	20.8
	Others	13	8.2
	Total	***n=159(had ITN)**	

**n= 62 denotes mothers who had no ITN at their home, and *n=159 denotes the number of pregnantwomen with ITN at their home.*

Table 5 five above revealed that 79.2%(175) had ever heard of ITNs, and 77.4%(171) mothers perceived that ITNs can prevent malaria transmission. Out of the 62, the majority 66.1% (47) had not received the ITNs, 11.3(7) reported that they were expensive, and the rest22.6%(14) reported that their ITNs were destroyed. The majority out of the 159 who hadITNs in their homes, reported that the ITNs produced itchy reactions after using it 59.5%(92),20.8%(33) reported that they never received enough information on the use of the ITNs, and the rest 11.3%(18) reported poor quality of the nets.

DISCUSSION

Ownership and sleeping under mosquito nets among women in their third trimesterof pregnancy at Kiryandongo Hospital

In this study, 72% and 43.5% out of the 221 sampled women in their third trimester had and were sleeping under their insecticide-treated mosquito nets respectively. This finding isconsistent with study findings from Ghana

(48%), Northern Ethiopia (58.4%), and Southwestern Uganda (35%). However, this level of sleep under the ITN is less than the report from Kenya (82%), and Ghana (68%). This could be attributed to the timing and differences in the studied population [24]. As reported in other studies, ownership and sleeping under the ITNs are not interconnected [22]. In this study, the relatively higher level of ownership and sleeping under mosquito nets could be attributed to the fact that the study involved pregnant women, who are among the priority groups for mass ITN distribution and that data was collected from the ANC unit where the ITNs are distributed. However, third-trimester mothers who had got ITNs in the first trimester were reluctant to use the nets towards the third trimester and the nets were getting holes. Although malaria in pregnancy puts both the mother and the intrauterine baby at risk for miscarriage, stillbirth, and intrauterine growth restriction, the government of Uganda targets 80% ownership of ITNs to vulnerable age groups that include pregnant women and children under five years. As it is expected that higher coverage of ITNs ownership would convert to higher use/sleeping under the ITNs, which has not been the case in this study.

Socio-demographic characteristics of respondents

The results of this study showed that the majority 52.9 % (117) were women in their third trimester aged between 25-34 years and were married 56.6% (125). However, in this study, the age of the mother and marital status was not significantly associated with sleeping under treated mosquito nets. A similar study finding was also reported in Northern Ghana, Bugiri district of Uganda among women of reproductive age, where age significantly was not significantly associated with sleeping under the ITNs [25, 26]. Although, a study done in Ethiopia, showed that pregnant mothers with ages, 35 were more than 4 times more likely to sleep under mosquito nets more than their other counterparts [24].

In this study, the least number of women were formally employed and the majority of the women were housewives 56.1 % (124). Occupational status was significantly associated with sleeping under treated mosquito nets, (x^2=13.968, p-value = 0.001). This could be attributedto the possibility that housewives could get social and economic support from their husbands who could buy the ITNS. This is not a surprise, as the majority of the women 50.7%
(112) depended on their husbands for financial support. Pregnant women who depended on their husbands were also significantly associated with sleeping under the ITNs (X^2=8.038, p- value = 0.045). This study result implies that husbands/partners play a big role in providing insecticide-treated mosquito nets to their treated women. A similar study finding was reported in South Western Uganda where occupation and source of income significantly affected sleeping under the treated mosquito nets [22].

The study also revealed that educational level was significantly associated with sleepingunder mosquito nets (x^2=8.372, p-value = 0.013). In this study, pregnant women who attainedat least a secondary level of education were less likely to sleep under treated mosquito nets. This is because pregnant women of higher educational levels could be using other methods of vector control to prevent mosquito bites. A similar study finding was also reported in Nigeria whereby attaining at least a secondary educational level was associated with a less likelihood to sleep under ITN [27].

Distance from the health facility was also significantly associated with sleeping under the insecticide-treated Nets. Pregnant women who were residing at a walkable distance and between 5-10km were more likely to be sleeping under the ITNs. This was because proximity to the hospital's ANC unit was associated with access to more ANC contacts which predisposed the mother to ITNs distribution and also attaining the right information regarding the useof the ITNs. Muhumuza *et al.* [26] in their study in the Bugiri district of Uganda, also highlighted that far distance from the ANC unit the pregnant mother reduced the chances of sleeping under the mosquito nets by 60%, as long-distance affected ownership and knowledge of ITNs.

Pregnant women with a previous history of malarial cases in the earlier trimesters were also more likely to sleep under ITNs. Suffering from two or more episodes of malaria in the current pregnancy created the perceived risk of getting malaria. Taremwa *et al.* and Onwejekwe *et al.* [22, 28-31] in their study, revealed that frequent and recent suffering from malaria influenced ownership and sleeping under the ITNs. These studies show that those suffering more cases of malarial sicknesses in a single month were more likely to sleep under treated mosquito nets than their counterparts who never or rarely suffer from malaria.

Knowledge of women in their third trimester of pregnancy at Kiryandongo Hospitalregarding ITNs use.

In this study, hearing about ITN and its importance in preventing bites from the infected mosquito was associated with sleeping under mosquito nets *(X^2=9.997, p-value, 0.02), (X^2=9.151, p-value, 0.010)*. Pregnant women who knew the importance of ITN were more likely to sleep under the insecticide mosquito nets than their counterparts who did not know that ITN prevents a bite from mosquitos. Similarly, respondents who knew when to have their mosquito nets properly tucked under the beds were significantly associated with sleeping under the mosquito nets *(X^2=13.370, p-value, 0.001)*. Pregnant women who reportedthat mosquito nets should

be tucked in immediately after it turns dark or immediately whenentering bed were most likely to use the ITNs properly than their counterparts who could tuckin their mosquito nets only when the mosquito nets were many. A similar study finding was also reported in Ethiopia where knowledge of the proper tucking time of the mosquito nets was significantly associated with sleeping under the ITNs regularly [27].

Perceptions of women in their third trimester of pregnancy at Kiryandongo hospitalregarding ITNs use. In this study, the reasons for non-possession of insecticide-treated mosquito nets among women in their third trimester of pregnancy; those who never received an ITN (66.1%), expensive ITNs (11.3%), and also the nets being destroyed (22.6%). This similar study result was reported in a cohort study done in Western Uganda, whereby pregnant women reported that they had no ITNs because they had not received them and expensive ITNs [22]. The study also revealed that the reasons for not sleeping under the insecticide-treated mosquito nets were feeling itchy after sleeping under the net, and poor quality nets. Among the respondents who reported itching after sleeping under the mosquito nets, it could be attributed to the fact that they did not receive enough information about hanging out the mosquito net for at least 24 hours before use.

CONCLUSION

In conclusion, the ownership (72%) and use (sleeping under)-43.5% of insecticide mosquito nets among women in their third trimester of pregnancy at Kiryandongo Hospital was higher than that of other target groups. The study revealed that socio-demographic factors including occupational status, educational level, income level, distance to the ANC unit, and previous history of malaria cases were associated with higher ownership and use of ITNs. In the study,we may also conclude that knowledge of the use of ITNs including knowing the importance of ITNs in preventing bites from infected mosquitos, and when to have the mosquito nets tucked in under the bed was associated with higher usage of ITNs among the respondents. The source of mosquito nets also mattered in the ownership and use of the mosquito nets.

RECOMMENDATIONS

To Ministry of Health Uganda

The result of these study findings can be useful in reviewing the national malaria strategic plan to incorporate targeted reproductive women's education for malaria control and more emphasis and follow-up during the third trimester in Uganda. In addition, public awareness and community support regarding ITNs for malaria prevention intervention should be emphasized to increase rather than just ITN ownership but also utilization to reduce malaria among pregnant women, especially during the last trimester.

To Kiryandongo hospital

The facility could as well embark on community outreach and awareness to increase ownership of ITNs among the general population. Also redistribution of ITNs during thethird trimester and sensitization about ITN usage.

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