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KNOWLEDGE, ATTITUDE, AND PRACTICES TOWARDS INSECTICIDE-TREATED MOSQUITO NET UTILIZATION AMONG PREGNANT WOMEN ATTENDING ANTENATAL CARE AT MASAKA REGIONAL REFERAL HOSPITAL, MASAKA DISTRICT: A CROSS-SECTIONAL SURVEY.

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ABSTRACT

Background

In Uganda, the Masaka district Health sector platform statistics from the Ministry of Health show malaria as the highest disease burden with 22.2%. Hence, as a result, ITNs have been well recognized there as part of the important components of Global and National malaria control policies.

Objective

To determine the knowledge, attitudes, and practices towards ITN utilization among pregnant women attending ANC at Masaka Regional Referral Hospital, Masaka District.

Method

A cross-section descriptive survey design was employed; 59 respondents were selected using a simple random sampling technique. Data was collected using a questionnaire and analyzed using frequency and percentages descriptive statistics.

Results

Study findings indicate majority 36(61%) knew their importance during pregnancy, 42(71.2%) knew what is correctly done before the first usage of an ITN, and some 16(27%) knew at least one of the two types of ITNs. A generally poor attitude towards ITN utilization among pregnant women was shown as up to 39(66%) didn't like to sleep in it, 36(61%) felt bad while sleeping under it, and 41(69.5%) believed that sleeping in it is not the only way to prevent malaria. Good practices towards ITN utilization were observed as a large number of 44(74.5%) slept under it, 30(50.8%) started sleeping in it during the first trimester, and 44(75%) hung their ITNs above the bed.

Conclusion

In summary, there was a high level of knowledge, poor attitude, and generally good practices about the utilization of ITNs among respondents.

Recommendation

The government needs to ensure the motivation of pregnant women to create a culture and enhance their understanding of ITNs. Direct health education through various mediums of communication should be carried out by the health workers. Health authorities should enhance the training of volunteers and local leaders towards proper utilization of ITNs through various directed programs by experts.

Keywords: *Malaria, Antenatal care, Insecticide-treated mosquito net, Knowledge, Attitude, Practice, Masaka Regional Referral Hospital*
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INTRODUCTION

Plasmodium parasites, which cause malaria, are an acute fever disease that humans contract by the bite of an infected female Anopheles mosquito. (World Health Organization (WHO), 2022). Pregnant women are more vulnerable to malaria than the general population; they have a higher chance of contracting the illness, having a recurrence, experiencing serious complications, and passing away from it. (Buh et al, 2019) Malaria contributes very significantly to maternal and fetal mortality. Malaria in pregnancy is different from the disease in the non-pregnant state. Hence the severity of malaria in pregnancy is thought to be due to

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general impaired immunity plus a diminution of acquired immunity to malaria in endemic areas. (Eyisi et al., 2022) In addition, the outcome of pregnancy is affected by malaria. Pyrexia from an acute attack of malaria may lead to spontaneous abortions or premature labor by producing uterine contractions. Abortions may also result from asymptomatic but intense death of the fetus. Malaria produces hemolysis when parasitized red cells rupture, also parasitized cells are constantly removed from the circulation by the spleen. This may result in anemia in pregnancy. Increased parasitemia is accompanied by marked cellular reaction in the placenta. This in turn interferes with the circulation of maternal blood through the intervillous spaces leading to impairment of oxygenation to the fetus and subsequent intrauterine growth restriction. (Eyisi et al., 2022)

Of 8.4 million pregnant women in Central Africa in 2021, 3.4 million (39.8%) had malaria infection hence the number of women infected was higher in East and Southern Africa (3.5 million) than in Central Africa (3.4 million) (WHO,2022).

A Framework for malaria elimination by the WHO Global Malaria Program recommended that Optimal coverage of ITNs/LLINs or IRS should be ensured and maintained in strata that are both receptive and vulnerable to malaria transmission. (WHO,2017).

Furthermore, the National Malaria Programs were directed to guarantee that everyone susceptible to malaria is protected by the IRS regularly or by providing, using, and replacing ITNs on time (WHO, 2021). Depending on the country context, both ITNs and IRS may be deployed across different geographical areas. (WHO, 2021). Thus, between 2000 and 2021, the percentage of people sleeping under an ITN increased significantly for all people (from 2% to 47%), children under the age of five (from 3% to 53%), and pregnant women (from 3% to 53%). Though overall, access to and use of ITNs remains below the levels observed in 2017. (WHO, 2022) There are 3 basic types of mosquito nets: Untreated Nets, Insecticides Treated Nets (ITNs), and Long-Lasting Insecticide Treated Nets (LLINs). Insecticide-treated nets are mosquito nets treated with insecticides. Developed in the 1980s, they are thought to be twice as efficient as untreated nets and provide more than 70% protection when compared to not using any nets at all (Ntonifor & Veyufambom, 2016). By killing and repelling mosquitoes, a synthetic pyrethroid insecticide like deltamethrin is applied to these nets, providing twice the protection compared to untreated nets. For maximum effectiveness, ITNs should be re-impregnated with insecticide every six (6) months. In most countries, ITNs have since been replaced with more durable, longer-lasting insecticidal nets (LLINs) (Eyisi et al., 2022).

A study about knowledge attitudes and practices of pregnant women towards utilization of ITNs conducted in North West Africa showed that more than half (55.9%) of mothers had good knowledge regarding ITNs. However, just 27.8% of moms reported always sleeping under an ITN, and 66.8% of mothers still had a negative viewpoint despite having an extensive understanding of them (Masaad et al., 2017). While the number of malaria cases in Uganda decreased by 8.7% from 14,904,773 in 2019–20 to 13,604,703 in 2020–21, malaria remains the most common diagnosis across all age groups in OPD. Accounting for 29.1% of OPD attendances, specifically in the Masaka area (Ministry of Health [MOH],2021)

Furthermore, the Masaka district Health sector platform statistics show malaria as the highest disease burden with a percentage of 22.2. Hence, as a result, ITNs have been well recognized as part of the important components of Global and National malaria control policies.

UMIS Atlas statistics show about 83% of households own ITNs in the Southern Buganda region of Uganda with the highest being 93% in the West Nile region, and about 62% of households' members use ITNs in Southern Buganda with the highest being 70% in the Bugisu region among others (MOH, 2019). The Third National Mass Campaign for Universal Access to Long-lasting Insecticide-treated Mosquito Nets (LLINs) for Malaria Prevention in Uganda notes that the government undertook the first mass LLINs distribution in 2010, targeting all pregnant women and children under five years of age (MOH, 2020). Hence contributing to a reduction in malaria prevalence from 55 to 32 according to the Uganda Malaria Indicator Survey 2014/15 (MOH, 2015). The country also aligned to the WHO guidance for universal coverage of one net for every two persons in a household. (MOH, 2020). Some studies were conducted after the campaign, and among those, in Jinja district, Uganda, a cross-sectional study conducted there revealed that pregnant mothers' knowledge of the use of insecticide-treated mosquito nets was good. However, the respondent's attitude towards the use of ITNs was poor/ negative as up to 60% of them felt putting on the mosquito net was inconveniencing, 67% didn't think that it was important to sleep under an ITN when one had taken Fansidar at ANC. Also, the practice of pregnant mothers towards the use of ITNs was not good as only (43%) of the mothers had ITNs. A large number (71%) couldn't afford them, and (10%) believed they didn't need them. Important to note too, that most (57%) mothers continued to use ITNS even when they had holes, (as 3%) used it for other things like catching white ants (Muwoya, 2021).

The study aims to determine the knowledge, attitudes, and practices towards ITN utilization among pregnant women attending ANC at Masaka Regional Referral Hospital, Masaka District.

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METHODOLOGY

Study Design

The study used a descriptive cross-sectional study design with qualitative and quantitative approaches, this study design was chosen because it helped obtain information in the shortest time possible and easily enabled the gathering of information without bias.

Study area

This study was conducted from the Antenatal Care (ANC) unit at Masaka Regional Referral Hospital in Masaka district. This Health Center was chosen because of the large number of mothers who turned up for antenatal services.

The hospital opened in 1927 as a treatment Centre for World War 1 veterans. It was elevated to Regional Referral Hospital Status in 1996. It is located 132km by road away from Kampala City in Masaka district. It is the main healthcare facility in the district serving over 3 million people in nine districts which include Masaka, Kalungu, Kalangala, Ssembabule, Lyantonde, Lwengo, Bukomansimbi, and Rakai. It has a 330-bed capacity with an annual admission of 2356 patients giving a bed occupancy rate of 90.6%.

This study was conducted in July 2023 within Masaka Regional Referral Hospital, Masaka District.

Study population

The study considered pregnant women who attended ANC at Masaka Regional Referral Hospital and were willing to voluntarily consent to participate in the study.

Inclusion criteria

The study targeted and included only pregnant women who were attending ANC at Masaka Regional Referral Hospital.

Exclusion criteria

The study didn't consider pregnant women who were attending ANC for the first time since it was known that they had not yet received a free ITN, those pregnant adolescents or under age below 18 years, pregnant women with severe illnesses such as cancer, those that were mentally sick, those that were physically disabled like the lame, blind, deaf, and dumb.

Sample Size determination

The sample size was calculated from a static formula, the Kish Leislie formula (1965).

Where,

n- Required sample size

e- Error of 5%

Q-(100-p)

z- Represented 1.96 critical value of the standard normal distribution.

The p-estimated prevalence of malaria in pregnant mothers was 0.96% of deaths occurrences in Africa (WHO, 2022).

Thus:

n = ((1.96)2 x0.96x(1-0.96)) ÷ (0.05)2

n= 59

Therefore, the sample size was 59 respondents in the study

Sample Size Selection Technique

To obtain the required sample size, a simple random sampling technique was applied, this technique was selected because it is free from bias and offered the same chance for every member of the target population to participate in the study, thereby obtaining balanced responses.

Sampling Procedure

To select the respondents, in this technique, "Yes" was written on ten small pieces of paper and "NO" on the other ten small pieces of paper, mixed them all in a box, and then instructed the pregnant women each to pick only one, whoever picked a paper with Yes was included in the study and was interviewed, this was done until all the fifty-nine respondents were interviewed.

Data Collection Methods

The questionnaire method was used for data collection. This method was adopted because it allowed participation in data collection and provided clarification and explanations wherever necessary. In addition, the questionnaire also collected data from many respondents in a short period.

Data Collection Tools.

Researcher-administered Questionnaires were used as tools of data collection since they were quick in collecting data within a short space of time and good at reducing errors as a result of question misinterpretation by respondents. The questionnaires were designed in a way that allowed information to be obtained & answer the research questions objectively. Other tools that were used included a Pencil, Eraser, Ink pad, Writing clipboard, and Paper.

Data Collection Procedure

The researcher administered a questionnaire form was compiled with questions about the knowledge attitudes and practices of pregnant mothers towards ITNs that were used to collect data from respondents.

Study Variables

Independent variables included; age, religion, tribe, parity, gestational age, and education levels.

Dependent variables included: The knowledge of the pregnant women regarding the use of insecticide-treated nets, the attitude of pregnant women towards the use of

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insecticide-treated nets, and the practices of pregnant women towards the use of insecticide-treated nets.

Quality Control

Data quality control was assured through, providing ample time for collecting data to enable to fully attend to the respondents. Moreover, consent forms were made indicating voluntary participation of respondents in the study thus collection of reliable data. Also, through pretesting questionnaires before the actual process of data collection.

Data Processing and Analysis

After gathering opinions from respondents, the data was sorted and entered into SPSS to derive frequency tables, charts, and graphs. In the same way, quantitative data was summarized and analyzed using descriptive statistics techniques of mean and standard deviation.

Ethical Considerations

This research study was conducted for purely academic reasons. As such, the views that were solicited from respondents were used for the same purpose. To build the confidence of the respondents, an introductory letter was obtained from the College authorities that was presented to the local health facility authorities and permission to conduct the study in the hospital was obtained. Then, with the guidance of medical staff, potential respondents were addressed and informed about their voluntary participation in the study. All matters arising from the questionnaire statements were explained correctly and a consent form was given to potential respondents. Furthermore, the data collection instrument was designed without providing the option for a name to increase the confidentiality of the respondents. The other innervation was that collection of the filled questionnaires was done considering convenience on the part of the respondents, hence written informed consent was also made for each participant

RESULTS

Demographic characteristics of respondents

Table 1.1: Distribution of Respondents according to Demographic characteristics (n=59)

VARIABLE	FREQUENCY	PERCENTAGE (%)
AGE		
<18	5	8.5
18-25	15	25.4
25-32	22	37.3
32-48	17	28.8
OTHERS (>48YRS)	0	0.0
TOTAL	**59**	**100.0**
TRIBE		
BAGANDA	35	59.3
BASOGA	8	13.6
BANYANKOLE	13	22.0
OTHER (ITESOT)	3	5.1
TOTAL	**59**	**100.0**
LEVEL OF EDUCATION		
PRIMARY LEVEL	26	44.1
SECONDARY LEVEL	14	23.7
TERTIARY	11	18.6
OTHER not educated	8	13.6
TOTAL	**59**	**100.0**

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In Table 1.1, 59 respondents were enrolled of which all of them agreed to participate in the study. The majority of the pregnant women 22 (37.3%) were between ages 25-32, 17 (28.8%) between 32-48, 15 (25.4%) between 18-25, and 5 (8.5%) aged below 18 years. The most dominant tribe was the Baganda which were 35(59.3%) followed by Banyankole 13 (22.0%) then Basoga 8 (13.6%) and lastly the Itesot tribe of 3 (5.1%).

Most of the respondents 26(44.1%) had attained a maximum primary level of education, 14 (23.7%) had attained a maximum of secondary level education, 11 (18.6%) had attained a tertiary education level and 8 (13.6) were not educated.

Table 1.2: Distribution of Respondents according to Demographic characteristics (continuation) (n=59)

RELIGION		
CATHOLIC	32	54.2
ANGLICAN	12	20.3
SEVENTH DAY ADVENTIST	2	3.4
MUSLIM	7	11.9
OTHERS (BORN AGAIN)	6	10.2
TOTAL	**59**	**100.0**
NUMBER OF CHILDREN		
ONE	12	20.3
TWO	17	28.8
THREE	8	13.6
FOUR	4	6.8
>FOUR	0	0.0
OTHERS (NONE)	18	30.5
TOTAL	**59**	**100**
AGE OF CURRENT PREGNANCY		
<26 WEEKS	13	22.0
26 -28 WEEKS	7	10.2
28-32 WEEKS	25	42.4
32-36 WEEKS	14	23.7
OTHERS (>36 WEEKS)	0	0.0
TOTAL	**59**	**100.0**

While in Table 1.2, in terms of religion, more than half of the respondents were Catholics 32 (54.2%), 12 (20.3%) were Anglicans, 7 (11.9%) were Muslims, 6(10.2) were Born Again Christians and lastly 2(3.4) were Seventh Day Adventists.

Majority of the respondents 18 (30.5%) had no children at home (nulliparous), 17 (28.8%) had two children, 12(20.3%) had one child, 8 (13.6 %) had three children and 4 (6.8%) had four children. Regarding the age of current pregnancy, the majority of respondents 25 (42.4%) were between 28-32 weeks, 14 (23.7%) between 32-36 weeks, 13 (22.0%) below 26 weeks and lastly 7 (10.2%) between 26-28 weeks.

Knowledge of pregnant women towards ITN utilization.

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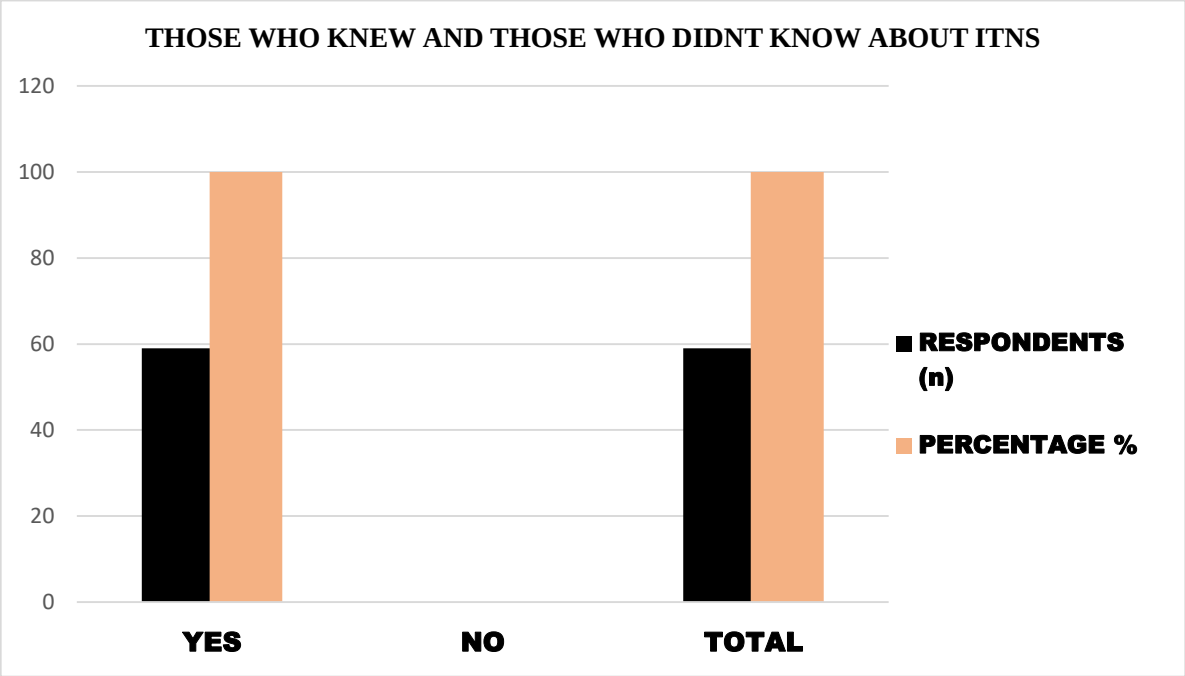
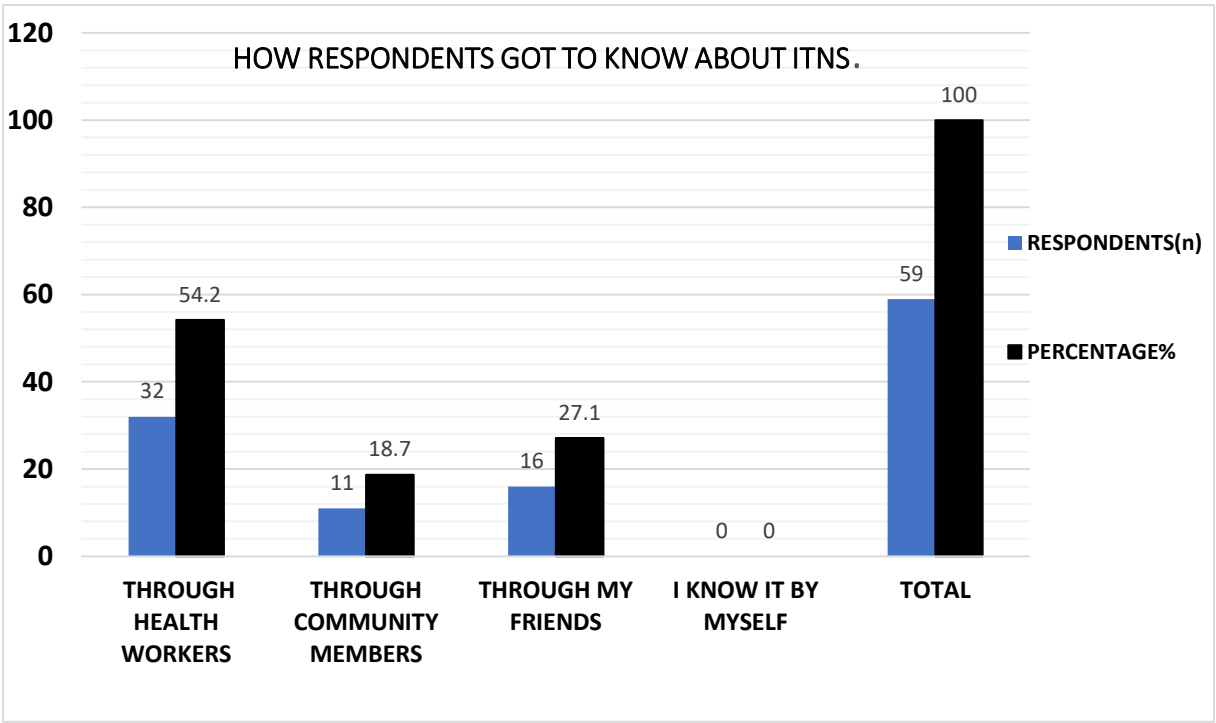
Figure 1: Showing percentages and numbers of mothers who knew about ITNs and those who didn't know about ITNs (n=59).



In Figure 1, all respondents were able to define an ITN as a mosquito net that a person sleeps in to prevent mosquito bites. All the respondents knew about ITNs and none was not aware of them.

Figure 2: Showing how respondents got to know about ITNs (n=59).



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In regards to Figure 2, more than half of the respondents 32(54.2%) got to know about ITNs through health workers, a few 16(27.1%) through their friends while the least 11(18.7%) through fellow community members and none knew ITNs by themselves.

Table 2: Showing the ideal importance of sleeping under a mosquito net. (n=59)

VARIABLE	FREQUENCY (n)	PERCENTAGE (%)
IMPORTANCE OF SLEEPING UNDER A MOSQUITO NET		
Prevent Malaria	23	39.0
Prevent mosquito bites	36	61.0
Get warmth at night	0	0.0
Kill rats	0	0.0
OTHERS	0	0.0
TOTAL	**59**	**100.0**

From Table 2, about the ideal importance of sleeping under a mosquito net, most of the respondents 36(61%) answered to prevent mosquito bites, and at least 23(39%) answered to prevent malaria while none answered getting warmth at night and killing rats.

Figure 3: Showing knowledge about what is done before first usage of an ITN, (n=59).

Figure 3 illustrates what is done before the first usage of a mosquito net according to the respondents. The majority of the respondents 42(71%) choose to dry it in the shade, a few 12(20%) choose to dry it in the sun, and the least 5(9%) choose washing it.

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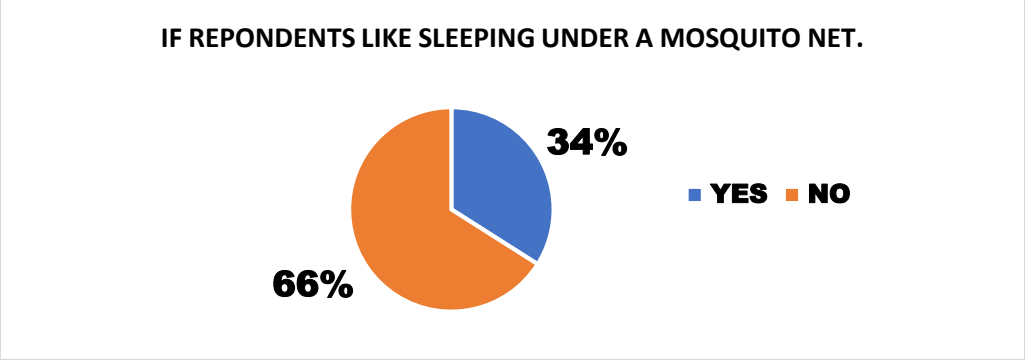
Table 3: Showing the knowledge about the two types of ITNs. (n=59)

VARIABLE	FREQUENCY (n)	PERCENTAGE (%)
THE TWO TYPES OF MOSQUITO NETS		
a. Conventionally treated nets only	16	27.1
b. Long-lasting insecticide-treated nets only	0	0.0
c. Untreated nets and wire mesh nets	6	10.1
d. Conventionally treated nets and long-lasting treated nets	0	0.0
e. OTHERS (Circular and Square mosquito nets)	37	62.7
TOTAL	**59**	**100.0**

In Table 3, most of the respondents 37(62.7%) referred to circular and square mosquito nets as being the two types of ITNs, 16(27.1%) could only identify conventionally treated nets and the least 6(10.1%) reported untreated nets and wire mesh nets, whereas neither of the respondents could identify long-lasting ITNs nor both conventional and long-lasting ITNs.

Attitudes of pregnant women towards ITN utilization.

Figure 4: Showing if respondents like sleeping under a mosquito net, (n=59)



From Figure 4, almost all respondents 39(66%) did not like sleeping under a mosquito net whereas the least 20(34%) liked sleeping under it.

The 39 respondents were further divided into reasons as to why they didn't like sleeping under a mosquito net. The majority 21(53.9%) reported feeling uncomfortable as they entrap a lot of heat, especially in hot seasons, a few 11(28.2%) reported their skin being irritated by the net chemicals and the least 7(17.9%) reported that mosquito nets make the bedroom look disorganized

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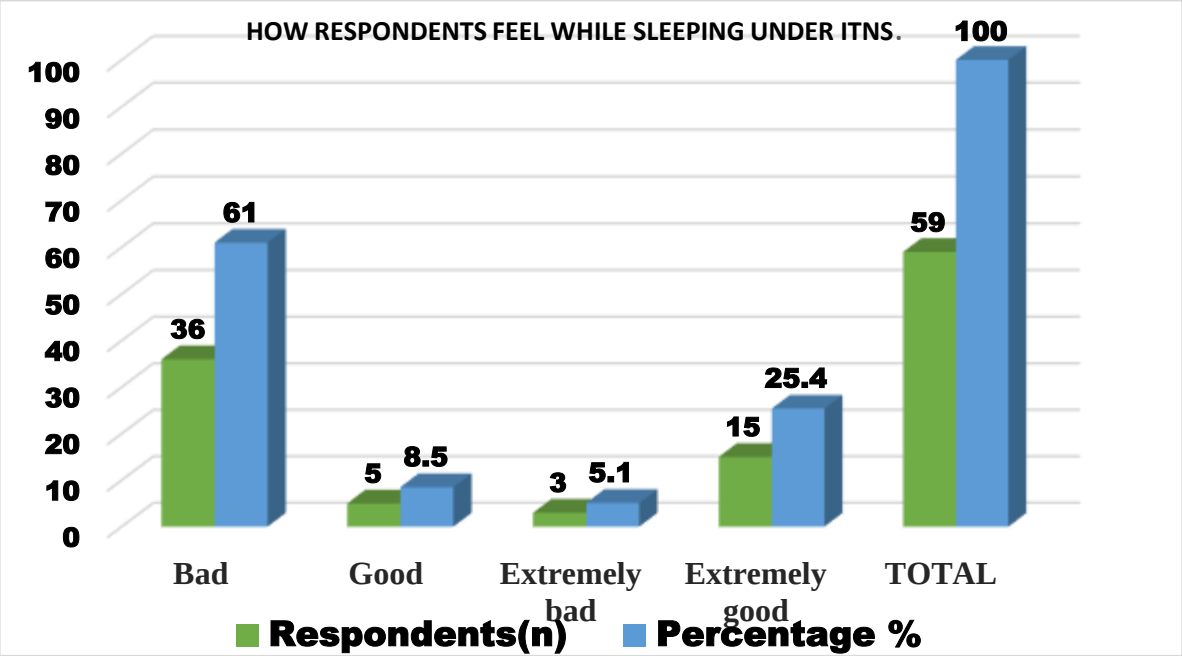
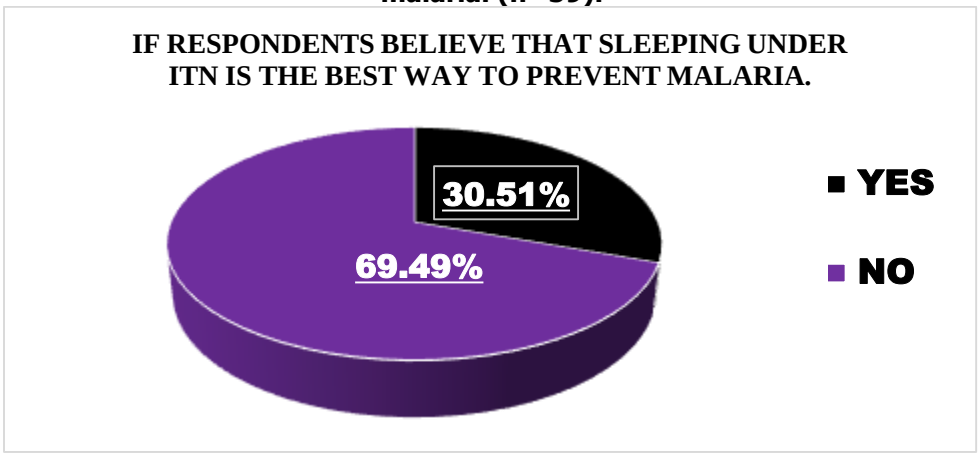
Figure 5: Showing how respondents feel while sleeping under a mosquito net. (n=59)



In regards to how respondents felt while sleeping under ITNs from Figure 5, the majority 36(61%) felt bad, 15(25.4%) felt extremely good, 5(8.5%) felt good, and lastly 3(5.1%) felt extremely bad.

Figure 6: Showing if respondents believe that sleeping under ITN is the best way to prevent malaria. (n=59).



From Figure 6, almost all respondents 41(69.45%) didn't believe that sleeping under a mosquito net is the best way to prevent malaria in pregnancy whereas the least 18(30.51%) believed. Those who didn't believe gave a reason that taking Fansidar during ANC is the most effective way to prevent malaria in pregnancy
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Table 4: Showing reasons as to why sleeping under a mosquito net during pregnancy is good and if respondents could recommend ITN usage to fellow women, (n=59).

VARIABLE	FREQUENCY (n)	PERCENTAGE (%)
Why sleeping under ITN is good during pregnancy.		
Ensures quick growth of baby	0	0.0
Prevents malaria in pregnancy.	23	39
Chases away rats at night.	0	0.0
Others (kills mosquitoes)	36	61
TOTAL	**59**	**100.0**
Can you encourage fellow women to sleep under ITN during pregnancy.		
Yes	43	72.9
No	16	27.1
TOTAL	**59**	**100.0**

From Table 4, in regards to reasons as to why sleeping under a mosquito net is good during pregnancy, more than half of respondents 36(61%) answered to kill mosquitoes, the least 23(39%) answered prevent malaria in pregnancy and neither answered ensures quick growth of the baby nor chasing away rats at night.

About if respondents would encourage fellow women to sleep under a mosquito net during pregnancy, almost all respondents 43(72.9%) replied yes meaning that they would recommend ITN usage to fellow pregnant women and the rest 16(27.1%) replied no. The least 16(27.1%) who wouldn't recommend fellow women to use an ITN during pregnancy attached reasons. Such as the irritating chemicals on the nets that cause skin irritability 11(68.9%), discomfort especially on hot days 3(18.8%), and rest didn't think it necessary to sleep under a mosquito net when one had taken Fansidar during ANC 2(12.5%).

Practices of pregnant women towards ITN utilization.

Table 5: Showing if respondents sleep under a treated mosquito net and reasons for not sleeping under a treated mosquito net for those who don't.

VARIABLE	FREQUENCY (n)	PERCENTAGE (%)
Do you sleep under a treated mosquito net?	**n1=59**	
Yes	44	74.6
No	15	25.4
TOTAL	**59**	**100.0**
If No, why?	**n2=15**	
Difficult to hung.	2	13.3
Don't feel comfortable under it	8	53.3
It is not effective	1	6.7
Because I take Fansidar	4	26.7
TOTAL	**15**	**100.0**

In Table 5, most of the respondents 44(74.6%) agreed that they sleep under a treated mosquito net and the rest 15(25.4%) said 'No', meaning that they don't sleep under a mosquito net. Of those who don't sleep under a mosquito net 15(25.4%) gave reasons as to why they don't use ITNs and the majority 8(53.3%) claimed that they don't feel comfortable under it, a few 4(26.7%) claimed that it's not necessary since they take Fansidar on every ANC visit,

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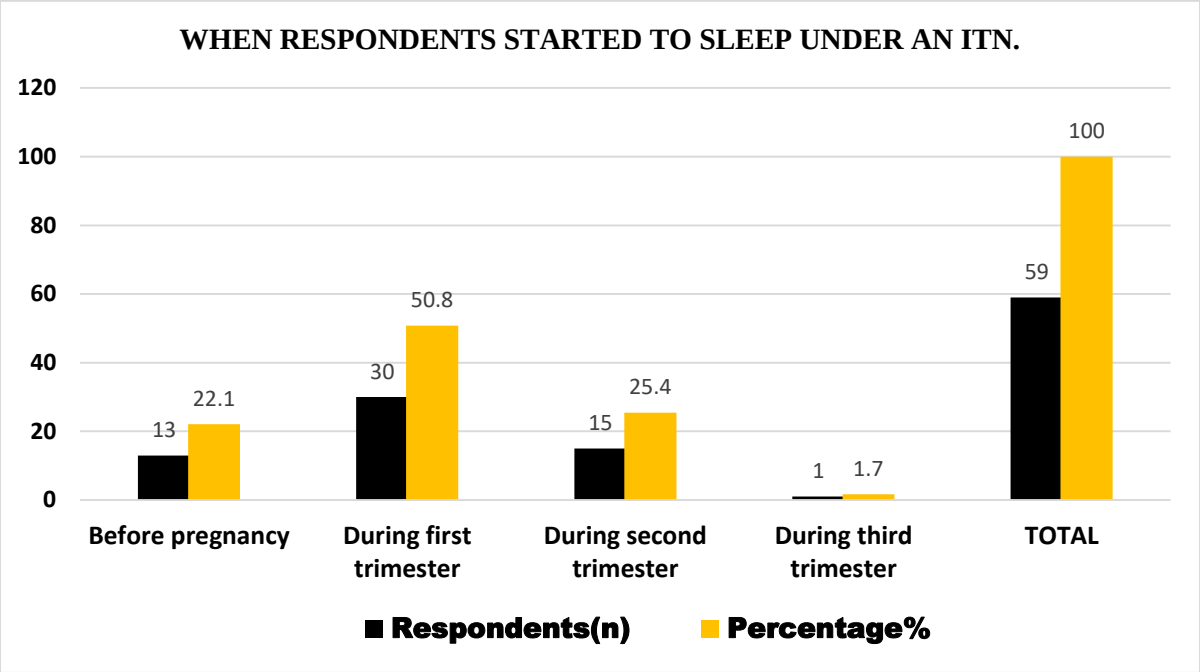
2(13.3%) respondents claimed that a mosquito net is difficult to hang and lastly 1(6.7%) respondent claimed that a mosquito net was not effective since she got infected with malaria in her second trimester after spending the whole of her first trimester sleeping in an ITN.

Figure 7: Showing when respondents started to sleep under a mosquito net, (n=59)



From Figure 7, the majority of the respondents 30(50.8%) started sleeping under an ITN during the first trimester, whereas a quarter of respondents15(25.4%) started during the second trimester, a few 13(22.1%) chose before pregnancy, meaning that they were already sleeping in an ITN even before pregnancy, and the least 1(1.7%) started sleeping in an ITN during the third trimester.

Figure 8: Showing the extent of sleeping under the mosquito net by the respondents. (n=59).

Figure 8, almost all respondents 43(73%) chose sometimes meaning that there are nights when they choose not to sleep in a mosquito net, 12(20%) respondents chose always meaning that they use an ITN every night, and lastly, 4(7%) chose often meaning that they only use their ITNs

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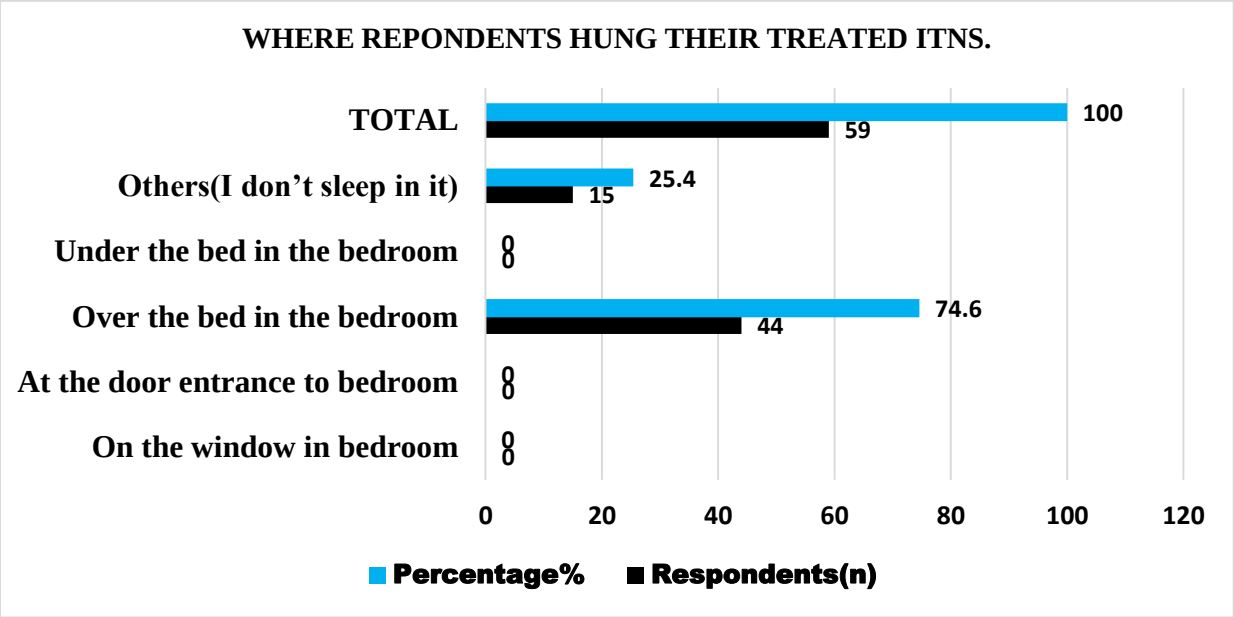
consistently when required like in only rainy seasons and don't use them in dry seasons.

Figure 9: Showing where respondents hung their treated mosquito net, (n=59).



From Figure 9, most of the respondents 44(74.6%) hung their mosquito nets over the bed in the bedroom, the rest 15(25.4%) said that they don't need to hang them because they don't sleep in an ITN and none choose on the window in the bedroom, at the door entrance to the bedroom and under the bed in the bedroom.

Table 6: Showing how respondents maintain their ITNs. (n=59)

VARIABLE	FREQUENCY (n)	PERCENTAGE (%)
How mosquito nets are maintained.		
Through washing it and placing it under shade.	23	39.0
Through washing it and placing it under direct sunshine.	17	28.8
Through removing it off from bed and storing it somewhere else.	15	25.4
Through reducing on movements while under the net.	4	6.8
TOTAL	**59**	**100.0**

In regards to how respondents maintained their ITNs from Table 6, the majority of respondents 23(39%) chose washing it and placing it under shade, 17(28.8%) chose washing it and placing it under direct sunshine, a quarter of respondents 15(25.4%) choose through removing it off bed and storing it somewhere else and the least 4(6.8%) choose through reducing on movements while under the net.

DISCUSSION

Socio-demographic data

The study revealed, that 22 (37.3%) of the respondents were between ages 25-32, 17 (28.8%) between 32-48, 15 (25.4%) between 18-25, and 5 (8.5%) aged below 18 years, there is no correlation between the age of respondents and the Knowledge, Attitude, and Practices of pregnant women towards ITN utilization.

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The most dominant tribe was the Baganda which was 35(59.3%) followed by Banyankole 13 l;(22.0%) then Basoga 8 (13.6%) and lastly the Itesot tribe of 3 (5.1%). This is probably because Masaka is in the Buganda kingdom and being the largest of all traditional kingdoms consists of many Baganda.

According to the level of education, most of the respondents 26(44.1%) had attained a maximum primary level of education, 14 (23.7%) had attained a maximum of secondary level education, 11 (18.6%) had attained a tertiary education level and 8 (13.6) were not educated at all. These findings imply that almost all the respondents had received some formal education which is why they knew about ITNs and even those who didn't receive formal education got to know about ITNs through the health education sessions at the hospital, these findings are in agreement with findings by *Masaad et al (2017)* which was a study about Knowledge, Attitude, and Practices Among Mothers Towards Insecticide-Treated Nets conducted in Abuharira Village, Sudan which found out that educational level is positively associated with knowledge of pregnant women towards ITN utilization.

In terms of religion, more than half of the respondents were Catholics 32 (54.2%), 12 (20.3%) were Anglicans, 7 (11.9%) were Muslims, 6(10.2) were Born Again Christians and lastly 2(3.4) were Seventh Day Adventists. This could be related to the fact that the composition of Catholics in the general population is higher than the rest of the denominations because of catholic missionaries who greatly spread the religion.

Regarding the parity of each respondent, the majority of the respondents 18 (30.5%) had no children at home (nulliparous), 17 (28.8%) had two children, 12(20.3%) had one child, 8 (13.6 %) had three children and 4 (6.8%) had four children. This is probably because many nulliparous women tend to attend regional referral hospitals more often than lower-ranking health centers.

Regarding the age of current pregnancy, the majority of respondents 25 (42.4%) were between 28-32 weeks, 14 (23.7%) between 32-36 weeks, 13 (22.0%) below 26 weeks, and lastly 7 (10.2%) between 26-28 weeks. This is likely to be a result of encouraged ANC visits.

Knowledge of pregnant women towards ITN utilization.

All respondents 59(100%) knew about ITNs and none were aware of them, as most of them said that an ITN is a mosquito net that a person sleeps in at night to prevent mosquitoes from causing malaria, implying that they had adequate knowledge about ITNs. This is probably because most of them had received some formal education and also, they got to know about them from the health education sessions during the ANC visits at the hospital. These findings are in agreement with the results obtained by *Manu et al., in 2017* which was a qualitative cross-sectional study about the Low Utilization of Insecticide-Treated Bed Net among Pregnant Women in Ghana and revealed that all respondents knew about ITNs.

More so, respondents were asked about how they got to know about mosquito nets, more than half of the respondents 32(54.2%) chose health workers, a few 16(27.1%) through their friends while the least 11(18.7%) through fellow community members and none knew ITNs by themselves, this shows that information of ITNs was fully passed on to respondents. The majority of respondents got to know about ITNs through health workers, probably because qualified health workers conduct health education sessions about ITNs on every ANC visit and also during community sensitizations thus increasing respondents' knowledge of ITNs. These findings are in agreement with those by *Muwoya, (2021)* which was a descriptive cross-sectional study about Knowledge Attitudes and Practices Towards the Use of ITNs Among Pregnant Women in Jinja District, Uganda, and attributed most of the respondents 75(57%) to getting information about ITNs from the hospital.

In regards to the ideal importance of sleeping under an ITN, most of the respondents 36(61%) answered to prevent mosquito bites, and at least 23(39%) answered to prevent malaria while none answered getting warmth at night and killing rats. This showed that information regarding the ideal importance of ITNs was fully passed on to respondents thus they were knowledgeable that the ideal importance of ITN is to prevent mosquito bites, however, this is in contrast to *Asumah et al., in 2021*, a descriptive cross-sectional study about the utilization of insecticides treated mosquito bed nets among pregnant women in Ghana in which about 90% of the respondents knew that ITNs were used to prevent malaria, meaning that their ideal importance of a mosquito net was to prevent malaria, but these differences in findings could be attributed to the geographical difference, beliefs, and sociocultural characteristics of the respondents.

Regarding what is done before the first usage of a mosquito net, the majority of the respondents 42(71%) choose to dry it in the shade, a few 12(20%) chose to dry it in the sun, and the least 5(9%) choose washing it. These findings imply that the majority of respondents were knowledgeable about what is first done before sleeping under an ITN, thanks to the health education sessions, those few who were not knowledgeable might have missed out on attending health education sessions about ITNs. The findings strongly agree with *a* study by *Asumah et al. in 2021* about the utilization of insecticide-treated mosquito bed nets among pregnant women in Ghana in which the majority of respondents 322(89%) were knowledgeable and chose to dry the ITN under shade before first usage whereas a few 25(6.90%) choose drying it in the sun and others 15(4.10%) washing it.

Nevertheless, when respondents were asked to choose the two types of ITNs, most of the respondents 37(62.7%) referred to circular and square mosquito nets as being the two types of ITNs, 16(27.1%) could only identify conventionally treated nets and the least 6(10.1%) reported untreated nets and wire mesh nets, whereas neither of the respondents could identify long-lasting ITNs nor both conventional and long-lasting ITNs. This implies that despite a few knowing only one type, most of the respondents didn't know the types of ITNs and instead they mistook the shapes of ITNs to be the types, probably because of insufficient health education about types of ITNs at the hospital or forgetfulness of respondents after being taught in health education sessions, These findings are in contrast to a study by *Masaad et al.(2017),* about Knowledge, Attitude and Practices Among Mothers Towards Insecticide-Treated Nets conducted in Abuharira Village, Sudan which found out that (94.2%) of mothers recognized all types of mosquito nets and (56.6%) of mothers specifically knew all the types of ITN like Long-lasting insecticidal net and conventionally treated nets.

The attitude of pregnant women towards ITN utilization.

The majority of respondents 39(66%) when asked if they liked sleeping under a mosquito net, they did not like it whereas the least 20(34%) liked sleeping under it. This shows the negative attitude of ITN utilization among respondents probably because of the following reasons given by those who didn't like sleeping under it:

The majority 21(53.9%) reported feeling uncomfortable under the nets as they entrap a lot of heat, especially in hot seasons, a few 11(28.2%) reported their skins being irritated by the net chemicals and the least 7(17.9%) reported that mosquito nets make the bedroom look disorganized. These findings are in agreement with a similar study by *Muwoya, 2021* about Knowledge Attitudes and Practices Towards the Use of ITNs Among Pregnant Women in Jinja District, Uganda in which the majority 67(53.2%) of respondents reported sweating a lot when using the ITN and That was related to the hot weather sometimes, a few (33%) felt safe while the least 17(13.5%) felt they could suffocate. Thus, respondents also had a negative attitude towards ITN use.

Most respondents 36(61%) felt bad when asked about how they felt when sleeping under a mosquito net, 15(25.4%) felt extremely good, 5(8.5%) felt good, and lastly, 3(5.1%) felt extremely bad. This implies the presence of a negative attitude towards ITN use as most of the respondents felt bad when sleeping under it this may be because of poor motivation towards ITN utilization by health workers. These findings disagree with a study by *Balami et al. in 2018*, about knowledge, motivation, self-efficacy, and their association with insecticidal net use among pregnant women conducted in Maiduguri, Nigeria. Over 70% of respondents felt that it was pleasant to use, and also believed it was also good for their pregnancies. And as such, it was as expected that, only a very small proportion of them felt sleeping under it was either very bad or somewhat bad to their health. It is unlikely for them to assume that health workers would give them any harmful material to use.

In regards to whether respondents believed that sleeping under a mosquito net is the best way to prevent malaria in pregnancy, almost all respondents 41(69.45%) didn't believe whereas the least 18(30.51%) believed. Those who didn't believe gave a reason that taking Fansidar during ANC is the most effective way to prevent malaria in pregnancy. This shows a negative attitude towards ITNs by respondents and these findings are in support of those by Muwoya, *in 2021*, in a similar study in which most 67(53%) said no hence they also didn't believe and it was because they also received other interventions like the use of drugs in antenatal (i.e., Fansidar).

Furthermore, in agreement with these findings a similar study by *Masaad et al. (2017),* about Knowledge, Attitudes, and Practices Among Mothers Towards Insecticide-Treated Nets was conducted in Abuharira Village, Sudan. Revealed that only 27.1% of mothers agreed that using an ITN is the best way to prevent a malaria infection, meaning that the majority of respondents didn't believe.

More so, when respondents were asked why sleeping under a mosquito net during pregnancy is good, more than half of them 36(61%) answered to kill mosquitoes, the least 23(39%) answered prevent malaria in pregnancy and neither answered ensures quick growth of the baby nor chasing away rats at night. This showed that most of the respondents didn't know the right reason (preventing malaria in pregnancy) for the positive attitude of utilizing an ITN, probably because of limited health education about that point. These findings disagree with those by *Taremwa et al in 2017***,** a study about Knowledge, attitude, and behavior towards the use of insecticide-treated mosquito nets among pregnant women and children in rural Southwestern Uganda, in which the majority 225(67.6%) of respondents agreed that use ITN is good and helps to prevent malaria, thus they were aware of the reason for the positive attitude towards net use during pregnancy.

Regarding whether respondents would encourage fellow women to sleep under a mosquito net during pregnancy, almost all respondents 43(72.9%) replied yes meaning that they would recommend ITN usage to fellow pregnant women, and the rest 16(27.1%) replied no. This is probably because most respondents were not selfish thus, they wanted others to use ITNs even though some felt bad using them, this is in agreement with a study by *Asumah et al. in 2021*, conducted in Ghana in which almost all respondents 348(96.10%) would recommend ITN usage to fellow women whereas the least 2(0.60%) wouldn't recommend it.

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In addition, the least 16(27.1%) who wouldn't recommend fellow women to use an ITN during pregnancy attached reasons such as the irritating chemicals on the nets that cause skin irritability 11(68.9%), discomfort especially on hot days 3(18.8%) and rest didn't think it's necessary to sleep under a mosquito net when one had taken Fansidar during ANC 2(12.5%).

Practices of pregnant women towards ITN utilization.

Most of the respondents 44(74.6%) agreed that they sleep under a treated mosquito net and the rest 15(25.4%) said no meaning that they don't sleep under a mosquito net. This shows the good practice of pregnant women towards ITN utilization and those who didn't sleep under a mosquito net attributed it to reasons such as feeling uncomfortable under it 8(53.3%) by the majority, a few 4(26.7%) claimed that it's not necessary since they take Fansidar on every ANC visit, 2(13.3%) respondents claimed that a mosquito net is difficult to hang and lastly 1(6.7%) respondent claimed that a mosquito net was not effective since she got infected with malaria in her second trimester after spending the whole of her first trimester sleeping in an ITN. These findings are in agreement with those by *Asumah et al (2021),* a similar study conducted in Ghana in which almost all respondents 343 (94.80%) used ITNs too and at least 19 (5.20%) didn't. Thus, showing good practices as well.

The majority of the respondents 30(50.8%) started sleeping under an ITN during the first trimester, whereas a quarter of respondents15(25.4%) started during the second trimester, and a few 13(22.1%) chose before pregnancy, meaning that they were already sleeping in an ITN even before pregnancy, and the least 1(1.7%) started sleeping in an ITN during the third trimester. This shows good practice towards ITN use in pregnancy as most of the respondents started sleeping in it during the first trimester, this may be a result of effective government interventions through ANC ensuring free access to ITNs in health facilities and also effective health education about complications of malaria in pregnancy to these women thus influencing them to use ITNs during pregnancy.

Regarding the extent of sleeping under an ITN, almost all respondents 43(73%) chose sometimes meaning that there are nights when they choose not to sleep in a mosquito net, 12(20%) respondents chose always meaning that they use and ITN every night daily, and lastly, 4(7%) chose often meaning that they only use their ITNs consistently when required like in only rainy seasons and don't use them in dry seasons. These results show limited practices towards utilization of ITNs as only 20.3% of respondents use them always, this may be attributed to the poor attitude of these respondents towards ITN usage. Hence agree with *Muwoya, (2021),* a descriptive cross-sectional study about Knowledge Attitudes and Practices Towards the Use of Insecticide Treated Mosquito Nets Among Pregnant Women in Jinja District, Uganda, where the biggest number 88(70%) used them once in while least, 9(7%) did not use them. Those who used them may have understood the benefits of sleeping under the ITN. Thus, limited ITN utilization practices among pregnant women.

Most of the respondents 44(74.6%) when asked about where to hang their nets, chose over the bed in the bedroom, the rest 15(25.4%) said that they don't need to hang them because they don't sleep in them. This implies good ITN usage practices as respondents correctly put their nets where they should be (over the bed), probably because of good knowledge from health education sessions about ITNs. These results are in full agreement with Okafor & Ogbonnaya's (2020) study on pregnant women's knowledge, accessibility, and use of insecticide-treated nets in a particular hospital in Southeast Nigeria. Whereas, 69.1% of respondents said they hung it above the bed and tucked it beneath the mattress to keep their bodies from coming into contact with it as they slept. Thus, good practice of ITN utilization.

In regards to how respondents maintained their ITNs, the majority of respondents 23(39%) chose washing it and placing it under shade, 17(28.8%) chose washing it and placing it under direct sunshine, a quarter of respondents 15(25.4%) choose through removing it off the bed and storing it somewhere else and the least 4(6.8%) choose through reducing on movements while under the net. These show the various measures that respondents employ to maintain their nets and most of the measures agree with the study by *Manu et al. in 2017,* a study about Low Utilization of Insecticide-Treated Bed Nets among Pregnant Women in the Middle Belt of Ghana in which respondents maintained their ITNs by preventing of holes in the nets, infrequent washing, reimpregnation, storing them properly and keeping them in a cool place to avoid decay of the insecticide in the nets. Hence good practices towards ITN utilization.

However same results also show poor practices towards ITN utilization and these a deployed by a few respondents 17(28.8%) who maintain their ITNs by placing them under direct sunshine instead of placing them under shade. This may be because lack of adequate knowledge of what needs to be done by the respondents.

CONCLUSION

The study findings indicate that all 59(100%) of the pregnant women knew about ITNs, the majority 36(61%) knew their importance during pregnancy, 42(71.2%) knew what is correctly done before the first usage of an ITN, and some knew at least one of the two types of ITNs. Thus, knowledge of pregnant women towards ITN utilization was good.

However, results have shown that respondents have a generally poor attitude towards ITN utilization as up to

39(66%) didn't like to sleep under an ITN, 36(61%) felt bad while sleeping under it, and 41(69.5%) believed that sleeping in an ITN is not the only way to prevent malaria.
Also, the findings have revealed that respondents generally have good practices towards ITN utilization as a big number of 44(74.5%) sleep under it, 30(50.8%) started sleeping in it during the first trimester, and 44(75%) hung their ITNs above the bed. Thus, good practices towards ITN utilization.

RECOMMENDATION

The study revealed that mothers have adequate knowledge about ITNs and good practices while the attitude of mothers towards the use of ITNs was poor, therefore the following recommendations should be undertaken:
Firstly, the government (both central and local) needs to ensure the motivation of pregnant women to create a culture and enhance their understanding of the utilization of ITNs. This should be achieved through initiating demonstration mosquito net campaigns and providing gifts while providing each mother with an ITN. This will improve their attitude towards ITNs.
Secondly, directed health education through various mediums of communication including radios, televisions, and newspapers among others to emphasize the positive attributes of using ITNs during pregnancy should be carried out by the health workers, this will further improve knowledge, attitudes, and practices of these women towards ITN utilization.
Thirdly, the Health Authority should enhance the training of volunteers and local leaders towards proper utilization of ITNs through various directed programs by experts so that accurate and adequate information about ITN utilization during pregnancy is passed on to pregnant women, this will further improve knowledge, attitude, and practices of these women towards ITN use.
Lastly, to best address the gaps in ITN utilization strategy, all stakeholders should be involved and engaged in ITN promotion campaigns including cultural leaders, religious leaders, health workers, community health teams, and the government of Uganda. This will ensure enhancement in the utilization of ITNs by pregnant women.

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LIST OF ABBREVIATIONS AND ACRONYMS.

WHO: World Health Organization
UMIS: Uganda Malaria Indicator Survey
ANC: Antenatal Care
ITNs: Insecticide-Treated Mosquito Nets
LLINs: Long Lasting Insecticide Nets
IRS: Indoor Residual Spraying
OPD: Out Patient Department
MOH: Ministry of Health
MRRH: Masaka Regional Referral Hospital
DCM: Diploma in Clinical Medicine

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