Barriers and Motivators for Mosquito Bed Nets Use during Pregnancy in the Middle Belt of Ghana

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ABSTRACT

Malaria in pregnancy is of global health concern. Free distributions of Insect-Repellent Preserved Nets (IRPNs) are introduced in Ghana to protect everyone particularly pregnant women from mosquito bites. This study aims at assessing the barriers and motivators to insecticide bed net use during gestation in the Kintampo Municipality.

This study employed a descriptive cross-sectional study that used a mixed methods approach to conduct the study. Multi stage sampling technique was used. Proportionate sampling was used to determine the number of respondents from each facility. Purposive sampling technique was used to select partners of ANC attendees for a focus group discussion.

Data was analysed using Stata version 15 and N-Vivo 12. Data triangulation techniques were used to merge the two data sources. Test of association between independent variables and dependent variable (ITN use) was examined using Chi-square test and logistic regression models to determine the strength of the relations. A p-value of ≤0.05 was deemed to be statistically significant.

Majority of pregnant women 71.4% sleep under treated insecticides net. Motivators for bed net use were to prevent mosquito bites 228 (83.2%) and to provide privacy 17 (6.2%). Barriers to bed net use were heat 59 (55.7%) and inconvenience in sleeping under the net 4 (3.8%). There is high rate of insect repellent pickled net use amongst antenatal women. Household arrangements as well as bed nets hanging challenges in the room are barriers to net use.

Key Words: Malaria, mosquito nets, usage, motivators, barriers and pregnancy

INTRODUCTION

Malaria is a preventable condition of communal well-being which has high annual morbidity and mortality rates. Malaria is the most devastative parasitic infectious disease with over one million mortalities annually (Schantz-Dunn & Nour, 2009). Prenatal women are potentially at risked of developing malaria at some point in their peri-conception periods (Manirakiza *et al*., 2017). Organizations such as Roll Back Malaria (RBM), Partnership to End Malaria, the African Union Commission and other partner organizations joins the WHO in encouraging "Zero malaria starts with me," a primary crusade targeted at rating malaria tall on the radical itinerary, mobilizing extra assets, then empowering societies' to take sole charge of preventing and caring for malaria cases in countries most affected by malaria ("WHO | Malaria," 2019).

Sub-Saharan Africa is greatly peaked with the burden of malaria in cyesis its dissemination is primarily substantial (Guyatt & Snow, 2001). Symbolic of malaria in cyesis in substantial dissemination localities implies that pregnant women are often well and healthy due to acquired immunity as a result of

repeated susceptibilities to malaria since early life. Most initial malaria manifestations are symptomless masking malaria detection and treatment until it causes complications (WHO, 2017). Prevalence of malaria parasites among pregnant women reports a 59.9% prevalence of malaria parasites in blood with first trimester peaked (84.1%). With positive recorded cases, mild cases (47.2%), moderate cases (37.4%) and severe cases (15.3%) (Ogbodo *et al.,* 2009). In sub Saharan Africa, the mechanisms, the intensity of transmission of malaria and the gravidity of its effects on pregnancy loss, which influences the magnitude of acquired protective immunity in antenatal women and the related risk of complications is unclear and poorly understood since it has not been well documented (Schantz-Dunn & Nour, 2009; Taylor & Ter Kuile, 2017).

The endemicity of malaria in Ghana is great and everybody in Ghana is at risk of getting malaria anytime. The prevalence rate of malaria remains at 40.0% of all OPD attendance, with pregnant women and children under five amongst the most exposed groups (Awine, Malm, Bart-Plange, & Silal, 2017).

Malaria in cyesis is a crucial public health concern which poses fundamental threats to the pregnant women and the unborn baby, the mother as well as the newborn child. Data available shows that not more than 40% of pregnant women sleep under ITNs in most malaria endemic African countries, indicating that ITNs use during pregnancy remains poor in spite of increased health campaigns by NMCPs and other government agencies (WHO, 2013).

Problem statement

Globally, 585,000 women die in developing countries from malaria in pregnancy related complications (WHO, 2011). Malaria in general is a serious worldwide public health issue, affecting over 3.3 billion people. Over 50% of the Antenatal clinic attendees are malaria positive (CDC, 2019; Rogerson *et al.,* 2018). In Ghana, death of pregnant women are considered a tragic event meanwhile significant percentage of the maternal mortalities that happen in Ghana are due to malaria infections among pregnant women which recently accounts for OPD attendance (28.1%), hospital admissions (13.7%) and maternal deaths (9.0%) (GHS, 2016; MOH-GHS, 2015).

Majority of pregnant women 178 (23.7%) of 750 pregnant women, 190 (100%) of 190 pregnant women, 224 (97.0%) of 231 pregnant women and 66 (67.3%) of 231 pregnant women were tested positive of malaria from Yizura Hospital, Glory Prince of Peace Maternity Home, Kintampo Municipal Hospital and Babator-kuma CHPS respectively (GHS/DHIMS2, 2018). ITNs are given to all pregnant women attending ANC as a strategy to reduce malaria. Despite this intervention, malaria still increased by 9.1% (Municipal Hospital Kintampo, 2018). A retrospective research indicated that, constant public dissemination of ITNS have greatly improved its accessibility in Ghana. Nevertheless, besides all these breakthroughs, ITN use in the Ghanaian population is still deficient. Governmental assessments gather meaningful data on the rate of ITN usage, accessibility and the contradictions across groups in Ghana(GSS/GHS/Macro International, 2015), and Statistics from the 2016 Malaria Indicator Survey have been researched in terms of use, access across the regions, gender, age and quantile of wealth. All three surveys were conducted between October and December, at the end of the rainy season going into dry season. Overall, the use-access ratio (UAR) was 0.63 in 2016, a small increase from 2014, but lower than the UAR in 2008 and 2011 (GSS/GHS/Macro International, 2015). Several studies have shown that there is a huge gap between availability of ITNs and usage, due to barriers, motivators and beliefs associated with ITN usage by pregnant women(Quist, 2015), which expose them to malaria infection resulting in underweight at birth,

preterm/early birth, anaemia, and maternal and newborn deaths (Runsewe, 2013). It is against this background that, the researchers seek to explore the barriers and the motivators for ITNs use during pregnancy in preventing malaria infections and its associated risks during pregnancy in the Kintampo Municipality.

General objective

The general objective of the study was to determine the motivators and barriers to ITNs use during pregnancy in the Kintampo Municipality.

Specific objectives

1. To determine the proportion of regular ITNs users during pregnancy in the Kintampo Municipality.
2. To assess the motivators to ITNs use during pregnancy in the Kintampo Municipality.
3. To assess the barriers to ITNs use during pregnancy in the Kintampo Municipality.
4. To assess the determinants of regular ITNs use during pregnancy in the Kintampo Municipality.

Conceptual framework

The risk of malaria can discourage investment, both internally and externally, and affect individuals, affecting household decision-making and negatively affect economic productivity and growth. Conceptually, the research focused on the following factors: Physiological, Behavioural, Environmental and Facility factors served as barriers and motivators for insecticide bed net use during pregnancy in the Kintampo Municipality.

The behaviour of health care workers may be influenced by a number of contextual factors (social demographic, socio-cultural and socio-economic characteristics) which may have direct impacts on the use of ITNs during pregnancy.

Behavioural factors, facility factors and environmental factors are also affected by the socio-demographic, socio-cultural and socio-economic features of the expectant mothers (Figure 1.0).
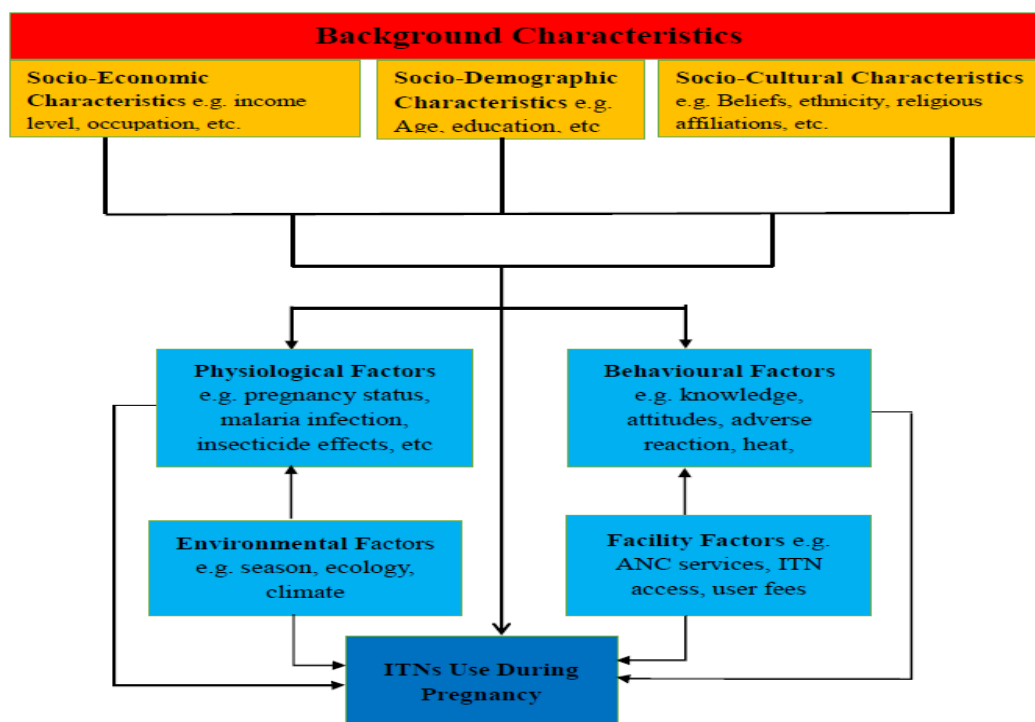

Figure 1: Conceptual framework of barriers and motivators for ITNs use during pregnancy.
Source: Researchers' own construct

Study design

Mixed research method has been employed in this study. A facility-based descriptive cross-sectional study, women seeking ANC services in the three health facilities in Kintampo Municipality: Kintampo Municipal Hospital, Yizura Hospital, Babator-kuma CHPS Compound and Glory Prince of Peace Maternity Home.

Study population

Study participants were women and their husbands seeking antenatal healthcare from the various hospitals within the Kintampo Municipality.

Sample size determination

Cochran's formula was used to determine the sample size. 95% confidence level, 5% margin of error, 35% represented the population proportion of the outcome variable (regular use of treated nets amid antenatal women) from a previous study(GHS/DHIMS2, 2018). Incorporating these variables into the formula:

$n= t^2 \times p (1-p)/m^2$

t= 95% confidence level with a z score of 1.96

p= 35% population proportion which is 0.35

m= 5% margin of error which is 0.05

$n= 1.96^2 \times 0.35 (1 - 0.35)/0.05^2$

$n= 1.96^2 \times 0.35 \times 0.65/0.05^2$

n= 350

n= 350 + 10% of 350

10% of 350 as non-respondents.

N = 385

Therefore, the total sample size was 385.

Sampling procedure

Multi-stage sampling technique was used in the study. Proportionate sampling technique was employed based on the data obtained from DHIMS 2 (2018) for the chosen facilities: KMH (224), Yizura hospital (178), Babator-kuma CHPS Compound (66) and Prince of Peace Maternity Home (190) respectively. Simple random sampling was implemented to choose the respondents.

A purposive sampling technique was applied to pick the partners of women who accompanied them to ANC for focus group discussion.

Inclusion and exclusion criteria
Inclusion criteria

Expectant mothers within all trimesters who were willing to partake in the research work were included in the survey.

Exclusion criteria

Women that met the inclusion criteria but did not consent to partake in the study were prohibited.

Data collection instrument

A semi-structured questionnaire was administered. Focus Group Discussion (FGDs) constituting 21 members was organized using focus group discussion guide to obtain more data.

Data analysis

Stata version 15 was employed to interpret the statistics that was accrued. Descriptive statistics was done on the demographic characteristics and the other variables. Pearson Independence chi-square test was performed to test association (p<0.05) between independents and dependents.

Multivariable logistic regression was done after the bivariate analysis to determine extent of associations. Tables and graphs were used to present the findings. FGDs were thematically analyzed using NVivo 12.

Ethical considerations

Ethical clearance was sought from the Ghana Health Service Ethics Review Committee (GHS-ERC080/10/19) for approval. Permission was obtained from the Regional Directorate of Health Services and the Kintampo Municipal Directorate of Health Services. The study's purpose was explained to hospital administration and participants, and they were assured of

privacy/confidentiality, data security, and acceptable data utilization and storage.

RESULTS
Background characteristics

Table 1: Respondents' SDCs (socio-demographic characteristics)

SDCs	Frequency (n=385)	Percentage (%)
Age:	27.43±0.32	
15-19	34	8.8
20-24	102	26.5
25-29	117	30.4
30-34	70	18.2
35-39	40	10.4
≥40	22	5.7
Tribe		
Akan	99	25.7
Mo	53	13.8
Gonja	31	8.1
Ewe	21	5.5
Dagarti	42	10.9
Dagomba	30	7.8
Fulani	12	3.1
Others	97	25.2
Religion		
Christianity	230	59.9
Islam	128	33.3
African Traditional Religion	23	6.0
Others	3	0.8
Marital status		
Single	68	17.6
Married	282	73.3
Divorced/Widow	8	2.1
Separated	27	7.0
Household size		
One	57	14.9
Two to three	115	30.1
Four to five	104	27.2
Six or more	106	27.8
Educational level		
No formal education	86	22.5
Primary	60	15.7
Junior High School/Middle School	99	25.9
Senior High School	77	20.1
Tertiary	61	15.9
Monthly income level		
≤GHS 300	224	60.0
GHS 301 - 500	75	19.7
GHS 501 - 1000	50	13.2
>GHS 1000	31	8.1
Residential status		
Rural	192	49.9
Urban	193	50.1

Mean age of respondents was 27.4±0.3 years. The majority of the respondents 117(30.4%) were between the ages of 25-29, with only 22 (5.7%) being 40+. Akan and others (Konkomba, Frafra, Kusase, Sisala, etc) were the dominant tribes with about half of the respondents in these two categories. Akan 99 (25.7%) and 'Others' 97 (25.2%). Most respondents 230 (59.9%) were Christians and 23 (6.0%) of the respondents subscribed to traditional religion. Again, majority 282 (73.3%) of the respondents were married and 8 (2.1%) were either divorced or widowed, and about a quarter 99 (25.9%) had basic education as illustrated in Table 1.

Gestational age of respondents/obstetric history

Almost half of the expectant mothers, 163 (42.3%), were in the second trimester, while nearly a fifth, 83 (21.6%), were in the first trimester. Antenatal women made up the majority of the population, accounting for 155 (40.3%) of the total. One-fifth of them had three or more children. Majority of the pregnant women (40.4%) had the ages of their last children to be between the ages of zero to two years. About one-fourth of them (26.1%) had last children with ages of four or more years. Table 2 illustrates the participants' pregnancy histories.

Table 2: Gestational age/obstetric history

Pregnancy history variables	Frequency (n=385)	Percentage (%)
Trimester		
First	83	21.6
Second	163	42.3
Three	139	36.1
Number of children		
None	155	40.3
One or two	153	39.7
Three or more	77	20.0
Age of last child		
Zero to two	153	40.4
Two to three	127	33.5
Four or more	99	26.1

Respondents' understanding on how to utilize a mosquito bed net

Majority 265 (69.0%) of the participants were able to identify malaria prevention methods. However, 4 (1.0%) of the participants also believed that use of mosquito repellent is not a method of preventing malaria. Majority 378 (97.7%) of respondents had heard about mosquito bed net at the time of interview, but only 323 (85.9%) of them knew it is used as a protection against mosquito bites. The highest source of information on bed nets identified by participants was health centre 211 (55.1%).

Table 3: Respondents' understanding on how to utilize mosquito bed net

Knowledge on malaria and ITN use	Frequency (N=384)	Percentage (%)
Malaria prevention method		
Sleep under mosquito nets	73	19.0
Drink clean water	265	69.0
Spray house/room with insecticide	14	3.7
Clear weeds around house	11	2.9
Keep surrounding clean	17	4.4
Use mosquito repellent	4	1.0
Awareness about mosquito bed net		
No	9	2.3
Yes	376	97.7
Uses of mosquito nets		
Room adornments	30	8.0
Anti-mosquito protection	323	85.9
Getting a good night's sleep	15	4.0
Fishing	7	1.9
Other	1	0.3
Sources of information about mosquito bed net		
Television	49	12.8
FM station	33	8.6
District Health Education	64	16.7
Hospital/clinic	211	55.1
Relatives/Peers	19	5.9
Other	7	1.8
Where to get mosquito net		
Clinic	42	11.0
Community volunteers	34	8.9
Pharmacy shop	65	17.0
Hospital	179	46.7
Other	63	16.4
Awareness about net re-treated		
No	236	61.6
Yes	147	38.4
Knowledge on frequency net re-treated?		
Every 3 months	49	33.8
Every 6 months	64	44.1
Does not retreat	27	18.6
Other	5	3.5
Availability of bed in the community		
No	148	38.7
Yes	121	31.7
Not sure	113	29.6

Again, the majority 179 (46.7%) of the participants believed the mosquito bed net can be purchased in health facilities while 65 (17.0%) of them were of the view that it can be bought in a pharmacy. Furthermore, the majority 236 (61.6%) were not aware the mosquito nets could be retreated as illustrated in Table 3.

Proportion of antenatal women who use a ITNs on a routine basis

Subjects were inquired if they consistently sleep under a ITNs during their current pregnancy to estimate the proportion of normal users of bed nets. The results showed that 272/385, representing 71.4% indicated they were regular users of bed nets (Figure 2).
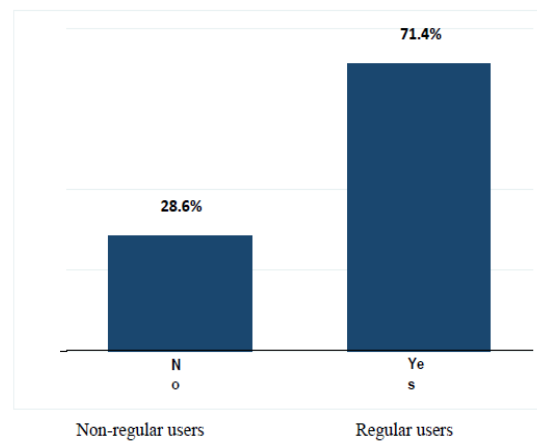

Figure 2: Regular and non-regular users of mosquito bed net

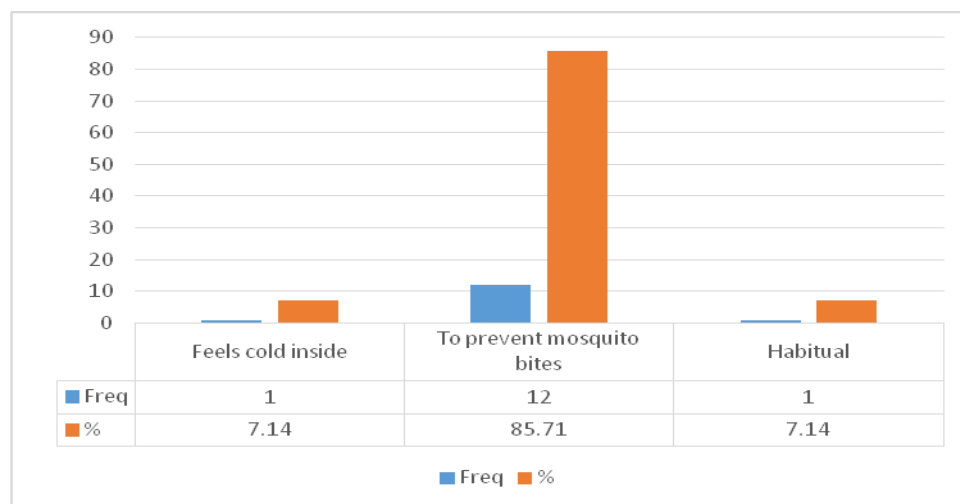**Why pregnant women regularly sleep under ITNs during pregnancy**

Figure 3: If yes why pregnant women regularly sleep under ITNs during pregnancy

Figure 3 below described why pregnant regularly sleep under ITNs during pregnancy. The findings showed that, 1 representing 7.14% felt cold when slept under the ITNs, 12 representing 85.71% stated they slept under the nets in order to prevent mosquito nets whereas the remaining 1 representing 7.14% said it was habitual sleeping under the ITNs.

Why expectant mothers do not sleep with ITNs on a regular basis

Figure 4 shows why expectant mothers did not sleep under ITNs on a regular basis throughout their pregnancies. The results showed that,4 representing 66.67% indicated they felt warm sleeping inside the net, 1 representing 16.67% said they looked like a burial shroud, whereas 1 representing 16.67% also affirmed that, there was no space to hang the ITNs hence the reason for non-use.
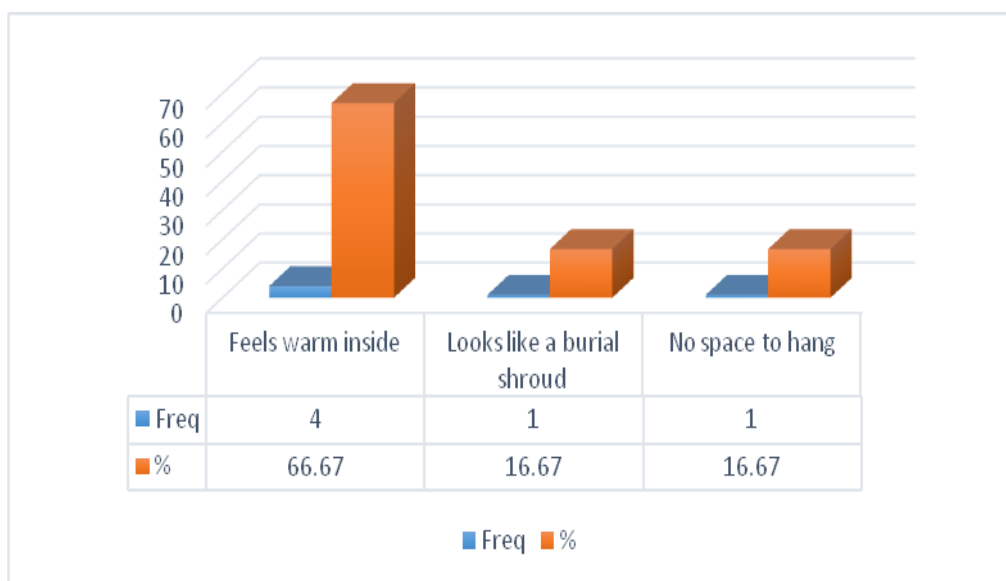

	Feels warm inside	Looks like a burial shroud	No space to hang
■ Freq	4	1	1
■ %	66.67	16.67	16.67

■ Freq ■ %

Figure 4: If no, why pregnant women do not regularly sleep under ITNs during pregnancy

Motivators to mosquito bed net use among antenatal care attendants at the Kintampo Municipality

With regards to sleeping under the bed net, majority 272 (71.4%) slept under it the previous night. Reasons for using bed nets identified in the study were to prevent mosquito bites 228 (83.2%) and to provide privacy 17 (6.2%). The majority 239 (62.9%) of the pregnant women indicated they use bed net all year round while 93 (24.4%) only slept under it during the rainy season. Focus group participants indicated that bed nets are comfortable to use during the rainy season because of increase in the number of mosquitoes and the cold weather as illustrated in Table 4.

"The majority of us use mosquito nets to safeguard ourselves from mosquito bites during the wet seasons. We have more

mosquitoes in this community during the rainy season. The weather is also cold and the bed nets provide warmth" (R3, FGD1)

Barriers to using ITNs during gestation in the Kintampo Municipality.

Majority 310 (81.4%) of the women hanged their bed nets while few 71 (18.6%) of them did not hang their nets. As to the reasons why they did not hang them, more than half 59 (55.7%) attested to the fact that, it was not part of their topmost priorities whereas, just 4 (3.8%) admitted that they were allergic to bed net use. Majority 272 (71.4%) of the respondents agreed to sleeping under their nets last night whiles minority 109 (28.6%) did not. On the reason why they did not sleep under it, 59 (55.7%) said they feel hot in it whiles 4 (3.8%) said because it looks like burial shroud. On the

wish to purchase a bed net, 227 (59.1%) expressed interest to purchase whiles, 157 (40.9%) said no, they would not buy. Majority 63 (39.9%) of those who said they would not purchase the bed net, said so due to financial problems but 12 (7.6%) said it Looks like burial shroud as illustrated in Table 5.

Table 4: Motivators to mosquito bed net use among antenatal care attendants at the Kintampo Municipality

Variables	Frequency (n=319)	Percentage (%)
Number of bed nets owned		
One	134	38.4
Two	131	37.5
Three	84	24.1
Used bed net night before survey		
No	109	28.6
Yes	272	71.4
Reasons for use of bed net		
Feels cold inside	10	3.7
For privacy	17	6.2
To prevent mosquito bites	228	83.2
Habitual	8	2.9
Advised by a midwife to use mosquito be	10	3.7
Other	1	0.4
Period when bed nets are used		
All year round	239	62.9
During rainy season	93	24.4
During dry season	14	3.7
Other	34	9.0
Reasons for using bed net during season		
To prevent malaria	330	86.8
For warmth	22	5.8
As a partition in the room	2	0.5
To provide privacy	8	2.1
Other	18	4.7
Benefits of mosquito bed net use		
To prevent malaria	318	83.5
To sleep soundly	25	6.6
To provide warmth	8	2.1
To prevent insects bites	26	6.8
Other	4	1.1
Ways to increase bed net ownership		
Reduce price	36	9.4
Community education on mosquito bed net use	102	26.6
Regular ANC attendance	94	24.5
Regular CWC attendance	2	0.5
Nets should be free	146	38.0
Other	4	1.0
Ways to improve mosquito bed net use		
Free distribution of mosquito bed net	245	64.5
Intensive education on mosquito bed net	105	27.6
Modification of shape and size of net	25	6.6
Other	5	1.3

Table 5: Barriers to mosquito bed net use during pregnancy in the Kintampo Municipality

Variables	Frequency	Percentage
Bed net currently hanged		
No	71	18.6
Yes	310	81.4
Reasons for not hanging net		
Not part of topmost priority	10	14.3
Allergic to use mosquito bed net	32	45.7
Looks like burial shroud	10	14.3
Others	18	25.7
Slept under mosquito net night before survey		
No	109	28.6
Yes	272	71.4
Reasons for non-use of bed net		
Feels hot inside	59	55.7
Looks like a burial shroud	4	3.8
No space to hang	18	17.0
Other	25	23.5
Willingness to buy bed net		
No	157	40.9
Yes	227	59.1
Reasons for unwillingness to buy bed net		
Financial constraint	63	39.9
Not part of topmost priority	60	38.0
Allergic to use of mosquito bed net	23	14.6
Looks like burial shroud	12	7.6
Having problems with the use of the net		
No	210	55.0
Yes	172	45.0
Barriers to bed net use		
Skin rashes	84	48.8
Generates heat	65	37.8
Cumbersome to use	21	12.2
Other	2	1.2

"When I use the bed net, I can't sleep because of the heat and sometimes I will be sneezing throughout because of the medicine in the net" (R7, FGD 2)

"It is difficult to get into the bed and out in the night to go and sleep. You know as pregnant women we urinate a lot in the night. So it is a very big inconvenience. Some of us too have problems hanging it because of the nature of our rooms" (R4, FGD 1)

Determinants of treated bed net use in the course of pregnancy in the Kintampo Municipality

Below are the determinants of regular ITNs use. The majority of the expectant mothers who slept under the bed nets the night before were married while those who were divorced were the least users of ITNs. In comparison to those who were not frequent users of bed nets 77(24.0 percent), the majority of pregnant women 244 (76.0 percent) who were regular users

of bed nets had enough knowledge on how to use them. The majority 164 (78.1%) of the regular bed net users had information about ITNs from health institutions. These determinants were all statistically significant at P<0.05. This is depicted by Tables below.

Table 6: Association between the motivators and regular bed nets use by pregnant women

Variables	Slept under bed net n (%)	Did not sleep under bed net n (%)	χ2	P-value
Marital status			31.88	<0.01*
Never married	4 (21.0)	15 (79.0)		
Single	33 (70.2)	14 (29.8)		
Married	214 (76.4)	66 (23.6)		
Divorced/Widow	3 (37.5)	5 (62.5)		
Separated	18 (66.7)	9 (33.3)		
Knowledge on uses of bed net			24.93	<0.01*
Room decoration	15 (50)	15 (50.0)		
Protection against mosquito bite	244 (76.0)	77 (24.0)		
Affording good sleep	9 (60.0)	6 (40.0)		
Fishing	1 (14.3)	6 (85.7)		
Other	0 (0.0)	1 (100.0)		
Sources of information about mosquito bed net			25.37	<0.01*
Television	27 (55.1)	22 (44.9)		
FM station	28 (84.9)	5 (15.2)		
District Health Education	42 (66.7)	21 (33.3)		
Hospital/clinic	164 (78.1)	46 (21.9)		
Relatives/Peers	8 (42.1)	11 (57.9)		
Other	3 (42.9)	4 (57.1)		

Motivators of ITNs use and its Association with Regular ITNs use by pregnant women

The strength of the link between ITNs usage motivators and their effects on regular use by women who were pregnant was determined using logistic regression. When compared to single women in cyesis, the married ones were 12 times more likely to sleep under a ITNs. Expectant mothers who heard about ITNs on FM radio were 5 times more likely to sleep under them than those who heard about them on TV. When compared to those who did not have ITNs, those who had three (3) were three times more likely to use it regularly as in Table7.

Table 7: Motivators of ITNs use by respondents and its association on Regular ITNs Use

Variables	Unadjusted				Adjusted		
	uOR	95% CI	P-value		aOR	95% CI	P-value
Marital status							
Single	1.00	-	-		1.00	-	-
Married	12.16	3.90 - 37.90	0.01		11.8	3.72 - 37.48	0.01
Divorced/Widow	2.25	0.37 - 13.71	0.38		1.84	0.29 - 11.47	0.52
Separated	7.50	1.92 - 29.30	0.01		7.24	1.83 - 28.65	0.01
Sources of information							
Television	1.0	-	-		1.00	-	-
FM station	4.56	1.51 - 13.79	0.01		4.69	1.54 - 14.28	0.01
District Health Education	1.63	0.76 - 3.52	0.21		1.60	0.73 - 3.47	0.24
Hospital/clinic	2.91	1.51 - 5.57	0.01		2.84	1.47 - 5.47	0.01
Relatives/Peers	0.59	0.20 - 1.73	0.34		0.56	0.19 - 1.66	0.30
Other	0.61	0.12 - 3.02	0.55		0.68	0.14 - 3.44	0.64
Number of bed net owned							
One	1.00				1.00		
Two	1.47	0.86 - 2.54	0.16		1.44	0.83 - 2.51	0.19
Three	2.49	1.24 - 5.00	0.01		2.43	1.20 - 4.91	0.01

Determinants of regular mosquito bed nets use of respondents and its association with sleeping under the bed nets

The magnitude of the link between respondents' background factors, awareness, and ITNs use was determined by logistic regression. Expectant mothers who have been married are 12 times more likely than those who have never been married to lie underneath the ITNs. Pregnant women who

heard about bed nets on FM stations are 5 times more likely to sleep under them than those who heard about them on TV stations.

Those who slept under ITNs were eight times more likely to do so than those who did not. This is illustrated in Table 8.

Table 8: Determinants of regular mosquito bed net use of respondents and its association with sleeping under mosquito bed net

Variables	Unadjusted			Adjusted		
	UOR	95% CI	P-value	aOR	95% CI	P-value
Awareness about bed retreated						
Every 3 months	1.00	-	-	1.00	-	-
Every 6 months	0.11	0.03 - 0.39	0.01	0.09	0.03 - 0.35	0.01
Does not retreat	0.29	0.06 - 1.31	0.11	0.25	0.05 - 1.18	0.08
Other	0.04	0.01 - 0.37	0.01	0.04	0.00 - 0.37	0.01
Problems of using bed net						
Skin rashes	1.00	-	-	1.00	-	-
Generates heat	0.45	0.21 - 0.96	0.04	0.35	0.15 - 0.80	0.01
Cumbersome to use	0.11	0.04 - 0.32	0.00	0.07	0.02 - 0.232	0.01
Own a bed net						
No	1.00	-	-	-	-	-
Yes	7.82	3.48 - 17.54	0.01	7.78	3.44 - 17.59	0.01
Periods bed nets were used						
All year round	1.00	-	-	1.00	-	-
During rainy season	0.30	0.18 - 0.53	0.01	0.31	0.18 - 0.53	0.01
During dry season	0.36	0.12 - 1.14	0.08	0.41	0.13 - 1.32	0.14
Other	0.05	0.02 - 0.13	0.01	0.05	0.02 - 0.12	0.01
Reasons for using bed nets at this period						
To prevent malaria	1.00	-	-	1.00	-	-
For warmth	0.46	0.19 - 1.12	0.09	0.47	0.19 - 1.15	0.10
As a partition in the room	1.00			1.00		
To provide privacy	1.92	0.04 - 0.82	0.03	0.18	0.04 - 0.77	0.02
Other	0.64	0.02 - 0.23	0.01	0.60	0.02 - 0.21	0.01
Benefits of mosquito bed net use						
To prevent malaria	1.00	-	-	1.00	-	-
To sleep soundly	0.32	0.14 - 0.74	0.01	0.30	0.13 - 0.71	0.01
To provide warmth	0.32	0.08 - 1.31	0.11	0.37	0.09 - 1.54	0.17
To prevent insects bites	0.37	0.17 - 0.84	0.02	0.36	0.16 - 0.81	0.01
Ways to improve mosquito bed net use						
Free distribution of mosquito bed net	1.00	-	-	1.00	-	-
Intensive education on mosquito bed net	1.04	0.61 - 1.75	0.90	1.02	0.60 - 1.73	0.94
Modification of shape and size of net	0.24	0.10 - 0.565	0.01	0.21	0.09 - 0.51	0.01
Other	0.54	0.09 - 3.33	0.51	0.75	0.12 - 4.76	0.76
Bed net currently hanged						
No	1.00	-	-	1.00	-	-
Yes	22.66	11.57 - 44.38	0.01	22.82	11.58 - 44.98	0.01
Where to get mosquito bed net						
No	1.00	-	-	1.00	-	-
Yes	3.28	2.07 - 5.20	0.01	3.33	2.08 - 5.33	0.01
Reasons for unwillingness to buy bed net						
Financial constraint	1.00	-	-	1.00	-	-
Not part of topmost priority	0.71	0.34 - 1.50	0.37	0.66	0.31 - 1.42	0.29
Allergic to mosquito bed net	0.13	0.04 - 0.41	0.01	0.11	0.03 - 0.36	0.01
Looks like burial shroud	0.48	0.14 - 1.66	0.25	0.40	0.11 - 1.45	0.16

DISCUSSION

ITNs have also been shown to reduce the likelihood of LBW newborns and malaria parasitaemia by 38 percent. ITNs have also been shown to reduce the likelihood of LBW newborns by 38 percent and malaria parasitaemia by 38 percent (ter Kuile *et al*., 2003). The current study revealed that, regular users of bed net were 71.4%. This number is very high and encouraging compared to other studies that were conducted in similar settings across the world. The findings from the study were supported by an earlier study in Tanzania on women anaemia during pregnancy by Marchant and colleagues. In comparison to individuals who do not use ITNs (32%), the researchers noted that up to 68 percent of expectant mothers use one on a frequent basis (Marchant *et al.,* 2002). Even though the latest results were noteworthy, they contrasted the findings of numerous other studies undertaken in various parts of the globe, which concluded that expectant

mothers rarely used ITNs (Akoria & Arhuidese, 2014).

Possession of ITNs was statistically significant at p<0.05. This discovery is in line with the findings of a research conducted in Kenya's Kilifi District (Rakiya et al., 2012). Most pregnant women were comfortable in sleeping under ITNs, during rainy season, knowledge on the benefits of ITNs, warmth it generates during cold weather and being non allergic to the chemical were the motivating factors similar to the findings of (Kimbi, Nkesa, Ndamukong-nyanga *et al.,* 2014; Allcock et al., 2018; Tijani, 2017). The implication is that, Kintampo and for that matter Ghana as a country is doing very well in the promotion of ITNs use among antenatal women seeking ANC services in the Kintampo municipality.

Impediments to regular ITNs utilization in the study were difficulty hanging mosquito bed nets, willingness of pregnant women to purchase ITNs and problems associated with ITNs utilization which is similar to the findings of (USAID, 2012;Solomon N Ukibe *et al*., 2014).

Marital status of pregnant women was statistically significant among the assessed socioeconomic factors. This is could be attributed to the fact that the participants were approximately equally distributed into rural and urban dwellers in the Kintampo municipality. Kintampo Municipal Hospital is the municipality's largest government health facility. The implication is that, most of the cases that are referred from smaller facilities come straight to KMH instead of the other medium facilities for further management. It's hardly unexpected that expectant mothers were evenly divided between urban and rural areas. Sohail *et al*., (2015), conducted in a semi-urban Indian neighbourhood in which the marital status of pregnancies was found to be statistically linked with malaria infection. Age, tribe, gestation, religion, parity, use of a bed net, education level, income, and occupation have all been linked to malaria in pregnancy

in other research. According to these studies, young expectant mothers are the most vulnerable to not sleeping under mosquito bed nets (Solomon N Ukibe *et al*., 2014; A debayo, Akinyemi, & Cadmus, 2015; Takem & D'Alessandro, 2013).

These determinants were all statistically significant probably because of the continuous health education by midwives and public health nurses on the importance of women's access to bed nets and sleeping under them. A similar study in Lagos state of Nigeria concluded on similar results (Aina & Ayeni, 2011).

CONCLUSION

Majority of the pregnant women were regular users of ITNs in the Kintampo Municipality. Factors such as heat associated with sleeping under insecticide treated nets and allergic reaction to medications used in treating the ITNs were among the barriers that prevented some of the pregnant women from utilizing the ITNs. Again frequent urination among some of the pregnant women made it difficult for them to sleep under the ITNs since they have to go under and out of the ITNs frequently to urinate in the night.

Recommendations

Community health nurses and midwives should continuously educate and encourage pregnant women to attend ANCs regularly. Kintampo Municipal Health Directorate (KMHD) should ensure that Community Health Nurses reinforce Information, Education and Communication (IE&C) tasks at outreach clinics and communities in the municipality. Further qualitative studies should be done on bed net use to unravel more predicting factors of treated mosquito nets.

Authors' Contributions

Both authors contributed to data analysis, revising or drafting the article, agreed on the journal to which the article is submitted, gave final approval of the version to be published, and agree to be

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