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FACTORS INFLUENCING THE UTILIZATION OF INSECTICIDE TREATED BED NETS (ITN) BY PREGNANT WOMEN IN THE WA EAST DISTRICT OF UPPER WEST REGION.

BY

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DECLARATION

I, Asani Dinkpee, do hereby declare that, apart from references made to other people's works, which have been duly acknowledged, this dissertation is the result of my independent efforts, and has not been submitted for the award of any degree in any institution.

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(ACADEMIC SUPERVISOR)

DEDICATION

To my dear wife, Madam Emelia N. Anasenchor and children, Fa-ez Tuohi-sung Dinkpee and Fa-ezah Hiera Dinkpee

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ABSTRACT

Background: Malaria burden among vulnerable groups is of immense public health importance. Both local and international stakeholders in health are harnessing efforts to curtail the consequences of malaria through control interventions like indoor residual spraying (IRS), intermittent preventive treatment (IPTp), seasonal malaria chemoprevention (SMC), and ITN use to reduce transmission. ITNs are freely distributed to meet universal coverage and the Abuja declaration of attaining over 80% LLIN utilization. Despite this, only about a third of the over 80% of owners sleep under ITNs globally. In Africa, ITN use ranges from 13.8% in Cameroon, 25.7% in Nigeria to 41.3% in Papua Guinea. In the Ghanaian context, ITN use ranges from 20% in the middle belt, 23.1% in the northern belt, 47% in the southern belt and the country as a whole. The socio-demographic, individual and seasonal variations have been found to influence ITN use.

Objective: To assess the influencing factors on the uptake of ITN among pregnant women in the Wa East district of the Upper West region.

Method: A cross-sectional study was conducted in four (4) sub-district health centers in the Wa East district. The district was stratified into 7 and simple random sampling used to select 4 health facilities. The 431 participants were recruited using random sampling through balloting. Descriptive summary statistics performed for frequencies while chi-test, simple and multiple logistic regressions performed to determine associations and strength of associations between ITN use and the independent variables with all results interpreted at 95% confidence level.

Results: The proportion of pregnant women that used ITN was 44% with 84.2% (363/431) ownership and 97.5% (420/431) awareness. Significant predictors of ITN utilization on multiple logistic regression were uncovered to be age, parity, place of residence, number of ITN owned,

the season of the year and the presence of mosquitoes (mosquitos' population density) in locality after adjusting for other confounders.

Conclusion: Ownership of ITN does not always translate to their use. About half of ITN owners do not use them. Key factors that are associated with ITN use are age, place of residence, number of ITNs owned and seasonal variations. ITN use among pregnant women in Wa East district is influenced by seasons and higher in the rainy season.

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LIST OF ABBREVIATIONS

ACTs	Artemisinin-based Combination Therapies
ANC	Antenatal Care
aOR	Adjusted Odds Ratio
BCC	Behavior Change Communication
C4D	Communication for Development
CDC	Centre for Disease Control
CHO	Community Health Officer
CHPS	Community–Based Health Planning and Services
CI	Confidence Interval
CWC	Child Welfare Clinic
cOR	Crude Odds Ratio
DDHS	District Director of Health Services
DHA	District Health Administration
DHMT	District Health Management Team
E	East
FGD	Focused Group Discussion
GDHS	Ghana Demographic and Health Survey
GF	Global Fund
GHI	Global Health Initiative
GHS	Ghana Health Service
GHS-ERC	Ghana Health Service Ethical Review Committee
GMIS	Ghana Malaria Indicator Survey
GMP	Global Malaria Program
GSS	Ghana Statistical Service
IBM	International Business Machine
ID	Identification Number
IDI	In-depth Interview
IIBN	Insecticide Impregnated Bed Nets
IPTp	Intermittent Preventive Treatment of pregnant women
IPC	Inter-Personal Communication

IRS	Indoor Residual Spraying
ITN	Insecticide Treated Bed Net
LLIN	Long Lasting Insecticide treated Net
MICS	Multiple Indicator Cluster Survey
MIP	Malaria in Pregnancy
MOH	Ministry of Health
MPH	Masters of Public Health
N	North
NMCP	National Malaria Control Program
OR	Odds Ratio
PI	Principal Investigator
PMI	President's Malaria Initiative
R	Respondent
RA	Research Assistants
S	South
SES	Socio-Economic Status
SPH	School of Public Health
SPSS	Statistical Package for Social Sciences
UG	University of Ghana
W	West
WHO	World Health Organization

DEFINITION OF OPERATIONAL TERMS

Insecticide Treated bed Net (ITN): An Insecticide Treated Bed Net (ITN) is either a factory based-treated bed net that does not require any further treatment or a bed net that has been soaked with insecticide within the past 12 months. Retreatment of ITNs, however, is not done nowadays

Long Lasting Insecticide-treated bed Net (LLIN): An LLIN is a factory-treated mosquito net made with netting material that has insecticide incorporated within or bound around the fibers. The current generation of LLINs lasts three to five years without retreatment or twenty (20) washes whichever comes first, after which the net should be replaced.

LLINs are a subset of ITNs, but in this study, the two terms are used to mean the same, and as such used interchangeably.

Used or Slept under an ITN: Any pregnant woman who slept under an ITN the night before the interview

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background

The use of insecticide-treated mosquito nets is a primary health intervention designed to reduce malaria transmission. An insecticide-treated net (ITN) is either a factory based-treated net that does not require any further treatment or a net that has been soaked with insecticide within the past 12 months. Long-lasting insecticidal nets (LLINs) are a subset of ITNs. An LLIN is a factory-treated mosquito net made with netting material that has insecticide incorporated within or bound around the fibers. The current generation of LLINs lasts three to five years without retreatment or twenty (20) washes whichever comes first, after which the net should be replaced (Ghana Statistical Service Accra, Ghana Health Service Accra, & The DHS Program ICF International Rockville, Maryland, 2014).

Malaria prevention and control is a major foreign assistance objective of the United States' (U.S) Government. In May 2009, President Barack Obama announced the Global Health Initiative (GHI), which is a comprehensive effort to reduce the burden of diseases especially malaria and promote healthy communities and families around the world. Through the GHI, the United States helped partner countries improve health outcomes, with a particular focus on improving the health of women, newborns, and children. The President's Malaria Initiative (PMI) is a core component of the GHI. The goal of PMI was adjusted to reduce malaria-related mortality by 70% in the original 15 countries by the end of 2015. This was to be achieved by continuing to scale up coverage of the most vulnerable groups - children under five years of age and pregnant women, with proven cost-effective preventive and therapeutic interventions, including insecticide-treated

nets (ITNs), intermittent preventive treatment of pregnant women (IPTp), indoor residual spraying (IRS) and artemisinin-based combination therapies (ACTs). (Usaid, 2015)

Following a successful universal mass ITN distribution campaign in 2012, starting in late 2013, Ghana's ITN strategy shifted its primary focus to maintaining ITN ownership through continuous distribution by employing the following channels: primary schools, antenatal care (ANC) clinics, and through vaccination programs offered through child welfare clinics (CWCs). It is hoped that PMI will continue to collaborate with national malaria control program (NMCP), Global Fund (GF), and department for international development (DFID) to sustain universal coverage through the continuous distribution strategy at designated outlets across the length and breadth of the country (Usaid, 2015)

Despite all these numerous and cost-effective malaria prevention and control interventions outside there, USAID, (2015) noted with concern that Malaria still remains endemic and perennial in all parts of Ghana, with seasonal variations that are more pronounced in the three northern regions.

Throughout Sub-Saharan Africa, malaria continues to be a life-threatening illness, where particularly, pregnant women and children being the most vulnerable with an estimated 10,000 women and 200,000 newborns dying each year as a result of malaria in pregnancy (MIP). Since 2004, WHO has supported a three-pronged MIP approach: (1) intermittent preventive treatment with sulfadoxine-pyrimethamine; (2) use of insecticide-treated bed nets; and (3) effective case management (Roman et al., 2015).

Malaria continues to account for 35% of deaths in children below the age of 5 years. Each year, between 3.1 and 3.5 million cases of clinical malaria are reported in public health facilities, of which 900,000 cases are children under-five. Malaria is indeed, a major cause of severe anemia, among pregnant women and children under-five (Afoakwah, Nunoo, & Andoh, 2015).

Regions of the world and partners in health across the globe have channeled resources and efforts to control malaria in endemic zones through the roll-out of numerous interventions that prevent and reduce malaria especially among pregnant women and children under five. Sleeping under an ITN is critically identified to be the most effective approach to preventing mosquito and other insects' bite, therefore could reduce the risk of malaria infection. Nonetheless, many are those especially vulnerable groups like pregnant women in greater proportions not sleeping under ITNs, giving rise to the numerous malaria morbidities and accompanying consequences that are registered in health facilities.

An array of predictors for the low utilization of ITNs by pregnant women could be operating at the individual level, encompassing: (Reacting to chemicals used to treat the net, the shape of the net, uncomfortable or suffocating when sleeping under ITN and intolerable Heat). Socio-demographic and cultural realm factors, as well as the presence of other malaria prevention and control Interventions, could precipitate the low use of ITNs by pregnant women.

There have not been any study in the Wa East district specifically on ITN utilization since the mass roll-out of the universal coverage in 2012 to determine the proportion of usage and associating influencing factors to the use of ITNs by pregnant women. Thus, for this reason, this study, therefore, seeks to assess the proportion of pregnant women who use ITN in the Wa East district and the factors that inform and influence their utilization of ITNs.

1.2 Problem Statement

Use of insecticide-treated nets (ITNs) during pregnancy is one of the proven cost-effective interventions in the fight against malaria burden. Most African malaria-endemic countries including Ghana have not achieved the target for ITN use among pregnant women set at least 80%

ITN utilization. A study by Chingle, Chirdan, Daboer, Ogbonna, & Zoakah, (2013) on ITN usage among pregnant women in the Plateau state in Nigeria revealed that a higher percentage of the women 90.4% own or possess ITNs with just 32.4% of them consistently using or sleeping in them. The Ghana Demographic and Health Survey (DHS) (2008) and the Multiple Indicator Cluster Survey (MICS) (2011) indicated that just 20% and 33% of pregnant women slept under ITN the night before the survey respectively. A related study in the Anambra state in Nigeria, authored by Ukibe et al, (2014) found that 94% of the participants were well aware of ITN with 60% owning at least an ITN with just 46% actually sleeping under ITNs. A study among pregnant women in the middle belt of Ghana found that ownership of ITN was 57.2% against 20% utilization Manu et al, (2017). A related study in the three northern regions of Ghana by Affokor et al, (2015) among children under five years indicated just 23.1% utilization of the ITNs by this group. Ernest et al, (2017), indicated that, though ITN ownership among pregnant women in the Ashanti region of Ghana – Kumasi, was 78% among ANC attendees, just 61% of them used their nets the night before the survey with an overall estimate of 47% ITN utilization. The Ghana malaria indicator survey (GMIS) (2016), estimated 67.1% and 60.8% utilization of ITNs among pregnant women and children under five respectively with 89.7% possession or ownership of ITNs by these vulnerable groups. The GDHS (2014) indicated 47% utilization of ITN among pregnant women.

Following the roll-out of the free universal ITN/ LLIN distribution and continuing at ANCs, gave ITN possession by households and pregnant women a great booster from 32.3% in 2008 to a coverage of 80% and 88.8% as revealed by (Ngwibete & James, 2016) & (Amedo, 2016) respectively. Despite increased access to this intervention over time, consistent ITN use remains relatively uncommon in most households by pregnant women. Having gained grounds in households' possession or ownership of ITN, one would have expected to see a replicated

proportionate increase in the use of ITN as well, this rather resulted in a great gap between households' possession of ITN with a coverage of 80% and actual use of ITN with a coverage of 18.1% as in the work of Ngwibete & James, (2016) . Several studies have indeed analyzed the impact, accessibility, availability, ownership, possession and percentage utilization of ITNs by pregnant women in far and near study location with few studies actually examining the intra-household hidden socio-demographic, individual and seasonal factors that predict, influence, affect or inhibit the utilization of ITNs by pregnant women, that widens the gap between ITN possession and utilization. This study seeks to determine by unearthing the factors that influence the use of ITNs and LLINs by pregnant women in the Wa East district.

The devastating consequences of malaria in pregnancy ranging from miscarriage, stillbirth, low birth weight, preterm birth, anemia, congenital malaria, high malaria burden or morbidity among this most vulnerable group and worst of all maternal and neonatal mortalities are most likely to perpetuate if studies are not delved into to fish out such factors or predictors that influence the use of ITNs by this group for appropriate recommendations and amendments, advocacy and BCC interventions to be tabled to safeguard the situation.

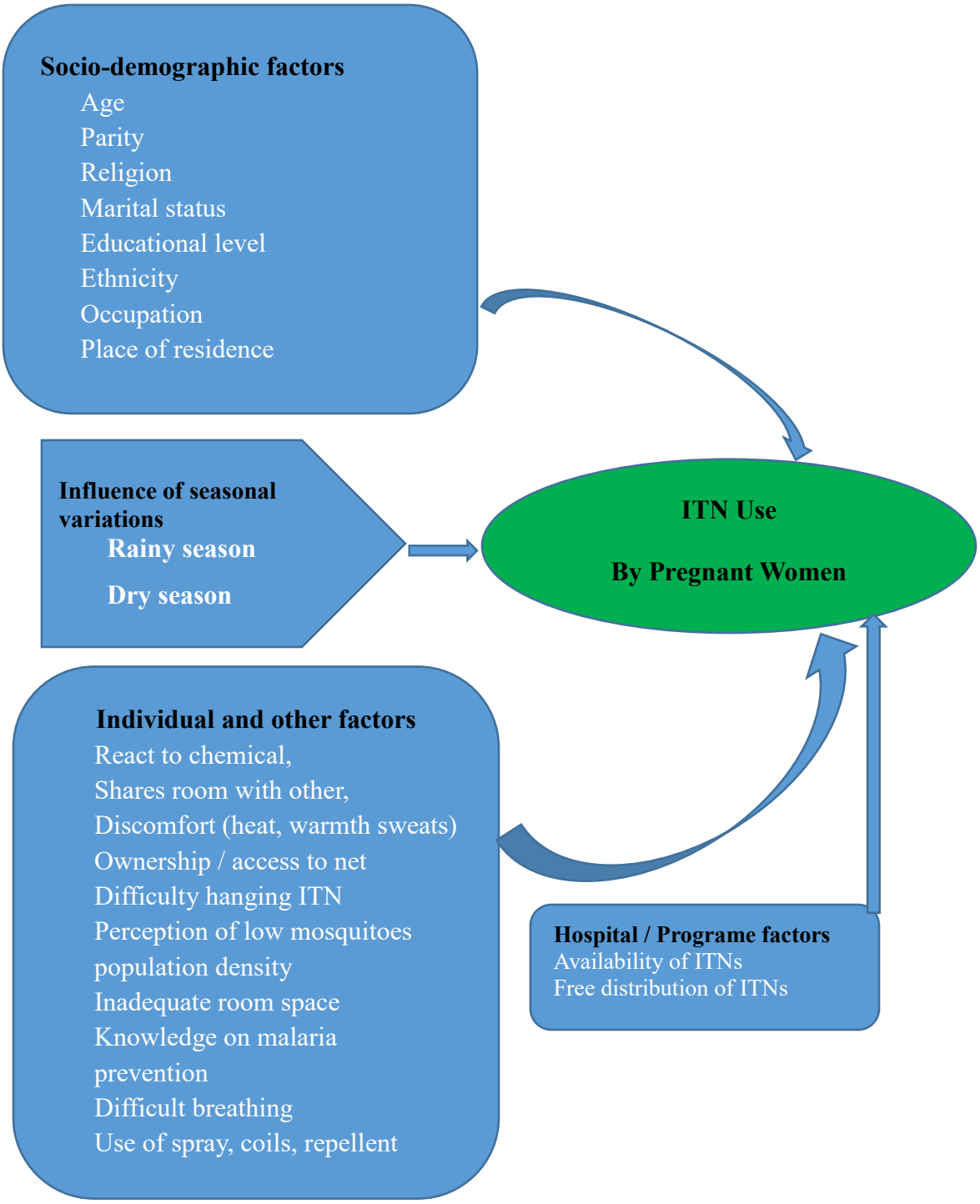

Figure 1: Conceptual Framework of the factors influencing the utilization of ITNs by pregnant women in the Wa East district, January 2018

1.3 Description to Conceptual Framework

The use of ITNs, especially by pregnant women and children, play a central role as a prominent and cost-effective strategy for achieving a reduction in malaria burden in Ghana and other malaria-endemic countries in sub-Saharan Africa. The conceptual framework, as portrayed in Figure 1, describes various factors that might contribute to the utilization of ITNs by pregnant women. These factors could be broadly classified under those relating to the individual (personal) factors, socio-demographic factors that could in one way or the other, influence ITN utilization. Individual preference to the shape of the ITN – conical or rectangular, skin reaction to chemical used in treating the net, sharing of room with others, heat, suffocation, and discomfort in using ITNs are possible personal factors that could influence ITN utilization. Demographic factors like age, parity, education, occupation, marital status, ownership of an ITN may all variably influence ITN use. Seasonal changes also greatly influence the utilization of ITNs by individuals. Access to ITNs with regard to their availability in health facilities' ANCs sites for free distribution to pregnant women. These and other factors interplay to influence pregnant women' decision to use an ITN or otherwise make a decision to sleep under ITN at bedtime.

1.4 Justification

This study will zoom and shine light on the factors that influence the utilization of ITN by pregnant women in the Wa East District thereby informing policy makers in the Ministry of Health, Ghana Health Service and other collaborating agencies and partners in health to design youth friendly Behavior Change Communication (BCC) strategies that will help improve and increase ITN utilization as a proven cost-effective intervention, especially among pregnant women and children under five years to improve or least sustain the gains in malaria prevention and control.

Vis-à-vis the successful rollout of the 2012/2013 LLIN hang-up campaigns, the 2014/2015

LLIN/ITN universal coverage (mass) distribution and subsequent 2016 onwards continuous LLIN / ITN distribution, there haven't been any reliable evidence-based information on the state of use of ITN coupled with the high burden of malaria despite influx of ITN across the district. The district health directorate will be anxious to have the results of this study to guide its health education and promotion activities, especially on malaria control as well adding to evidence for policy advocacy.

Results of this study will also serve as a baseline information to set the pace for hearty research in the future regarding malaria control in the district and beyond.

1.5 Research Questions

The following research questions guided this study.

1. What is the proportion of pregnant women that use or sleep under ITN in the Wa East District?
2. Which socio-demographic and other related factors influence pregnant women in the Wa East district to use ITNs?

1.6 Study Objectives

1.6.1 General Objective

To assess the utilization of ITN among pregnant women in the Wa East District.

1.6.2 Specific Objectives

1. To determine the proportion of pregnant women who use ITN in Wa East District
2. To assess the socio-demographic and other individual factors that influence pregnant women in the Wa East district to use ITNs.

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Introduction

This section presents reviewed studies on ITN use among pregnant women and factors that influence pregnant women on ITN utilization.

2.2 Malaria situation

In 2012, an estimated 627,000 people died of malaria—most were young children in sub-Saharan Africa. Within the last decade, increasing numbers of partners and resources have rapidly increased malaria control efforts. This scale-up of interventions has saved 3.3 million lives globally and cut malaria mortality by 45%, leading to hopes and plans for elimination and ultimately eradication. Malaria occurs mostly in poor tropical and subtropical areas of the world. In many of the countries affected by malaria, it is a leading cause of illness and death. In areas with high transmission, the most vulnerable groups are young children, who have not developed immunity to malaria yet, and pregnant women, whose immunity has been decreased by pregnancy. The costs of malaria – to individuals, families, communities, nations – are enormous (CDC, 2015). In Africa, many reasons account for why it is extremely difficult to control malaria encompasses: an efficient mosquito that transmits the infection, a high prevalence of the most deadly species of the parasite, favorable climate, weak infrastructure to address the disease, and high intervention costs that are difficult to bear in poor countries. However, the scale-up of effective, safe, and proven prevention and control interventions made possible by global support and national commitment has shown that the impact of malaria on residents of malaria-endemic countries can be dramatically reduced when these are used together.

2.3 Prevalence of ITNs use among pregnant women

Malaria during pregnancy has adverse consequences including miscarriage, stillbirth, low birth weight, preterm birth, anemia, and maternal and neonatal mortalities at last. Use of insecticide-treated nets (ITNs) during the period of pregnancy is one of the proven cost-effective interventions in the fight against malaria burden. Most African malaria-endemic countries including Ghana have not achieved the target for ITN use among pregnant women – at least 80% ITN utilization. A study among pregnant women in the middle belt of Ghana found that ownership of ITN was 57.2% against 20% utilization Manu et al., (2017) attributing discomfort, heat, and smell of the net for the non-use of ITNs. A related study in the three northern regions of Ghana by Afoakwah et al., (2015) among children under five years indicated just 23.1% utilization of the ITNs by this group. Ernst et al., (2017) found out that though ITN ownership among pregnant women in the Ashanti region of Ghana – Kumasi, was 78% among pregnant women attending ANC, with just 61% of them using the nets the night before the survey with an overall estimate of 47% ITN utilization. The Ghana malaria indicator survey by Ghana Statistical Service (GSS), Ghana Health Service (GHS), ICF, (2017) estimated 67.1% and 60.8% utilization of ITNs among pregnant women and children under five respectively with 89.7% possession or ownership of ITNs by these vulnerable groups. A related study in the Anambra state in Nigeria, authored by Ukibe, Ikeako, Mbanugo, Obi-Okaro, & Ukibe, (2014) found that 94% of the participants were well aware of ITN with 60% owning at least an ITN with just 46% actually sleeping under ITNs. The GDHS by Ghana Statistical Service (2014) indicated 47% utilization of ITN among pregnant women.

A study by Kimbi et al., (2014) among vulnerable groups in the Buea health district of Cameroon found that 83.4% of the respondents used ITNs throughout the year, 13.8% used ITNs during the rainy with 3.4% using their ITNs in the dry season.

ITN use by pregnant women was associated with living in block-louver houses than in block-pane houses with a P-value of 0.047. The study found that 69.7% of households, that owned ITNs, reported using them the night before the survey. A decade ago under the Roll Back Malaria (RBM) Partnership, Abuja targets were set where at least 60% of pregnant women who usually at risk of malaria infection have access to antimalarial chemoprophylaxis or IPTp-SP by 2005, and at least 80% use of ITNs by 2010. These targets were subsequently reset with even more ambition to 100% use of both interventions by 2015 (Menéndez, Ferenchick, Roman, Bardají, & Mangiaterra, 2015) and (Roman et al., 2015).

A study by Ankomah et al., (2012) in Nigeria on the determinants of ITN use among pregnant women found that only 25.7% of them used an ITN the night before the survey. Educational level was not significantly related to ITN use although registration at ANC was significantly associated with ownership of an ITN (perhaps through free ITN distribution), this does not translate to significant use of ITNs.

The knowledge that ITN prevents malaria, urban dwelling and not holding of misconceptions were found to be positively associated with ITN use (Ankomah et al., 2012). A coverage 39.5% and 41.3% utilization was also noted among children under five and pregnant women respectively by Hetzel et al., (2012) in Papua New Guinea.

2.4 Factors influencing the use of ITNs

The factors influencing the use of ITNs would be classified into three broad sections by this study. These factors include socio-demographic factors, individual or personal related factors as well as factors related to seasonal variations.

2.4.1 Socio-demographic factors.

Kimbi et al., (2014) in their study related that married pregnant women were 6.69 times more likely to sleep under ITN compared with single pregnant women with a p-value of 0.014, at [95% CI: 1.46– 30.64]. In a another, Atieli et al., (2011) noted significant differences in ITN use among different age groups where children under 5 had a percent usage of 78.4% against children between 5-14 years with percent usage of 69.1% whiles adults 15 years and above had a percent usage of 72.2% implying children were more likely to use ITNs compared to other age groups. They further added that educational level and knowledge about malaria transmission were some of the significant reasons affecting ownership and usage of ITN. People with higher education and knowledge were found to be more likely to use ITN compared with their counterparts with a lower level of education.

Baume & Franca-Koh, (2011) found in their work that pregnant women in rural locations were rather than urban areas were more likely to use ITNs than those in urban settings with an [OR: 1.92; (95% CI: 1.49-2.47)]. Also, those of lower socio-economic status (SES) were found to be more likely than those of higher economic status to use ITNs with (OR: 1.11) for each level decrease in SES [95% CI: 1.01-1.22]. Those who have not used coils for mosquito control in the past 12 months were also more likely to have slept under INTs with [OR: 1.48; (95% CI: 1.20-1.83)]. Again, women with fewer net were more likely to sleep under an ITN compared with those with higher number of nets, as the author found that those who had fewer nets (one net) had an [OR: 7.47; (95% CI. 4.87-11.43); (p: 0.000)], those with two nets had an [OR: 1.93; (95% CI: 1.23-3.02)] compared to those with three or more nets. Pregnant women of higher educational level were also significantly more likely to use ITN compared to those with no / less education with an [OR: 2.32; (95% CI: 1.58-3.40)].

Ernst et al., (2017) also revealed that married pregnant women were more likely to sleep under an ITN compared to non-married pregnant women with a p-value of 0.024. The results of the GDHS (2014) revealed that women of low socio-economic status (SES) were about two times more likely to have slept under an ITN (68.3%) compared to pregnant women of higher socio-economic status (SES) (37.2%).

Atieli et al., (2011b) study in Kenya is in line with Baume & Franca-Koh, (2011) findings where higher education was significantly associated with ITN utilization**.** In a related study in the by Eteng et al., (2014) in north-central Nigeria on socio-cultural factors influencing the utilization of ITNs, married women were more likely to sleep under ITNs than separated women and they were also more likely to use ITNs than women that were single. Also, higher education had a significant association with ownership of ITN and its subsequent use compared to individuals with lower educational background.

2.4.2 Individual and other factors influencing the utilization of ITNs by pregnant women.

Some outstanding reported social barriers to the use of ITNs outlined in a study by Kimbi et al., (2014) were poverty, color, and shape of ITN, feeling uncomfortable under an ITN were mentioned by the subjects. A strong evidence of association [95% CI: 0.052–0.524] was also noted in the use of ITN between income earning pregnant women and non-income earners where pregnant women who earned some income were 0.16 times less likely to use ITN than their non-income counterpart. This study further indicated that there was a statistically significant difference observed, where pregnant women in urban communities were 5.99 times more likely to sleep under ITN than those in rural communities with [95% CI: 1.078–33.29]. Low indoor temperatures and significantly high numbers of very nuisance mosquitoes were also positively associated with the use of ITN in the highland areas of western Kenya as revealed in the work of Atieli et al., (2011).

Pregnant women described feeling hot and uncomfortable under the net while sleeping and the inconvenience of putting it up and taking it down each night as well as the belief that the chemicals used to treat the ITNs were harmful to pregnant women and their unborn child was reported as a barrier in studies in Kenya, and Uganda, ((Hill et al., 2013), Van Geertruyden, 2005) and in Ghana (Donkor, 2011) which led to many women discontinuing use of ITNs (Hill et al., 2013).

According to Baume & Franca-Koh, (2011), pregnant women who knew that mosquitoes actually transmit malaria were more likely to sleep under an ITN compared to their counterparts who never knew that mosquitoes transmit malaria with an [OR: 1.38; (95% CI: 1.03-1.86)]. The author noted that in terms of net characteristics, a net was significantly more likely to have been used the prior night if it was newer compared to old or worn out nets with an [OR: 2.44; (95% CI: 1.46-4.05)]. Also, light blue nets were 1.38 times more likely to be used as opposed to white [OR: 1.38; (95% CI: 1.04-1.83)]. The study again noted with concern that, pregnant women who paid for or bought their ITNs were 1.88 times more likely to use them as against ITNs that were freely distributed [OR: 1.88; (95% CI: 1.49-2.38)].

A study by Manu et al., (2017) in the central bet of Ghana around Kintampo among pregnant women found that more than 90% of respondents found ITNs to be uncomfortable to use, during pregnancy, with regard to the fact that they entrap heat especially during warm weather / dry seasons where 15% of them can not at all sleep under an ITN without fun. The chemical used to treat the nets was described to have an unpleasant smell resulting in about 15% of pregnant women vomiting or experiencing difficulty in breathing making them not to sleep under ITNs. Below is a verbatim report from a respondent in a FGD supporting this point.

> *"Because of the medicinal scent in the net, some pregnant women do not want to sleep in it, because it will make them vomit though sleeping in an ITN will prevent you from getting malaria. (R6: FGD, D/Nkwanta)*

> *There is always heat in the ITNs so during pregnancy it becomes uncomfortable to sleep in. You would, therefore, wish to pour water on the ground to sleep on. That is why we cannot sleep in an ITN. (R5: FGD, Akumsa* Domase)"

The author indicated that about 51.7% of the respondents outlined some alternative malaria prevention / control strategies they use including: the use of mosquito coil, mosquito spray/indoor residual spray, and repellants or burning other substances to drive mosquitoes away to prevent their bites that make them not to use ITNs as reported by one of them in an in-depth interview conducted in Kakuma.

> *"You can buy mosquito coil and light it in your room to prevent the mosquitoes. You can also burn the palm kennel to prevent mosquitoes in our homes.* (IDI, Kokuma)"

A classic study by Binka & Adongo, (1997) in the Northern part of Ghana on the Acceptability and use of insecticide-impregnated bed nets (IIBNs) in northern Ghana revealed that the use of the bed nets was predominantly seasonal with almost all recipients (99%) using their IIBNs in the rainy season which denotes and is the peak of the period of high mosquito density and just 20% of the respondents using them in the dry seasons, the period of low mosquito density. A related study by Pell, Straus, Andrew, Meñaca, & Pool, (2011) also found that the uptake of ITNs as an intervention in malaria control basically depends on the season where rainy or dry season and that factors like the discomfort in ITN use and the perceived potential harm the chemical used on the net could have on the pregnant woman and her unborn child, mostly were the factors scaring them from ITN use in Africa. Ukibe et al., (2014) in their study in the Anambra state in Nigeria revealed that factors like heat (40%), inadequate accommodation / room space to hang net (13.3%), net causing itching (0.7%), just don't like nets (0.4%), not having any reason for nonuse of nets were mentioned by the respondents as the reasons why they are not sleeping under ITNs. A similar study in Cameroon by Kimbi et al., (2014) showed similar results with seasonal variation greatly influencing ITN use by pregnant women where about four folds increase in ITN use was recorded

(13.8%) in the rainy season compared to the dry season (3.4%). Atieli et al., (2011a) study in Kenya also found related results where ITN usage during the dry and hot season was significantly lower (49.5%) than that in the rainy cool season (61.8%) with an [OR: 0.6; (χ^2: 37.8)]. Seasonal variations slightly influenced the ownership of ITNs by respondents where there was an increase in ITN possession from 71.4% in the dry season to 73.8% in the rainy season.

CHAPTER THREE

METHODS

3.1 Study Design

It was a quantitative cross-sectional study.

3.2 Study Area

The study was conducted in the Wa East District which is one of the eleven (11) districts in the Upper West Region of Ghana.

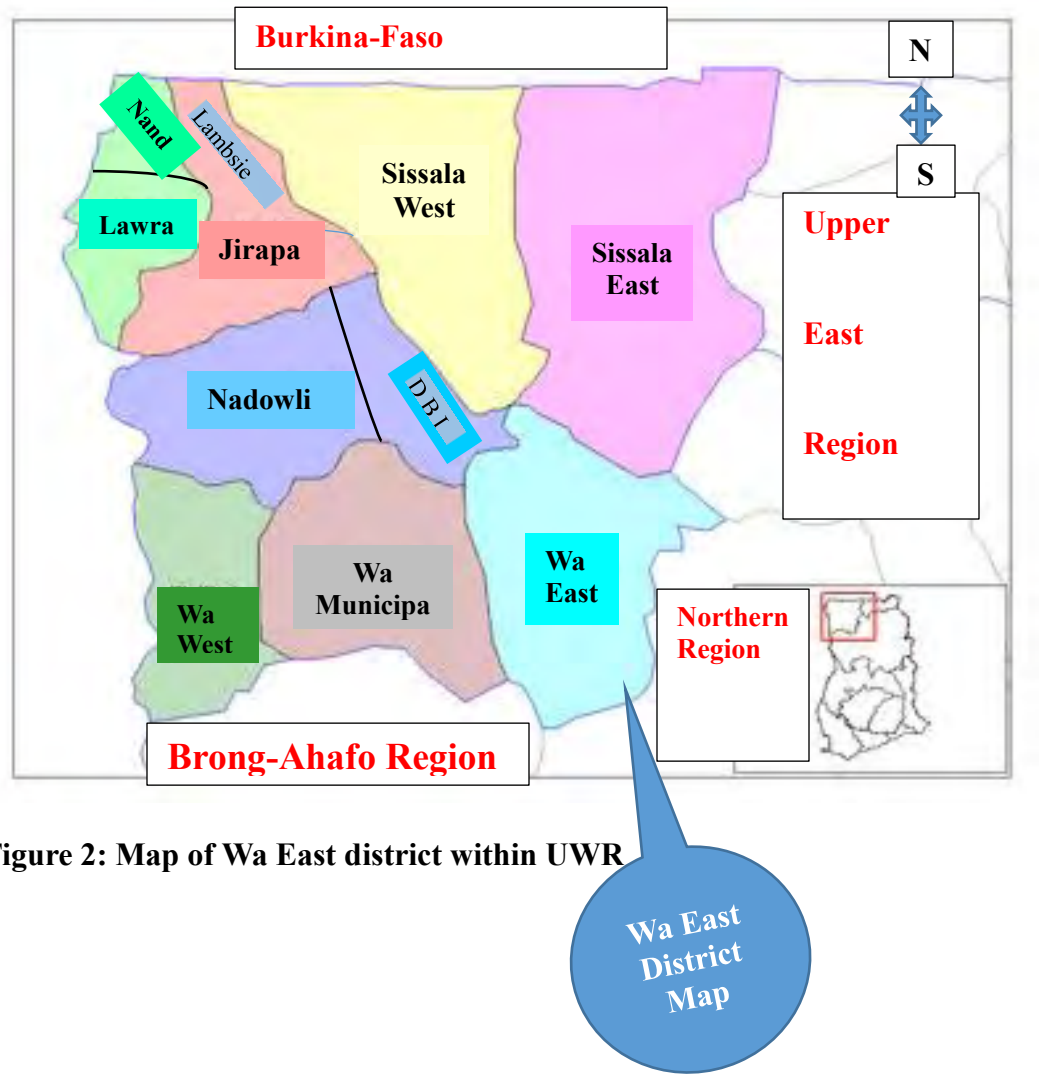

Figure 2: Map of Wa East district within UWR

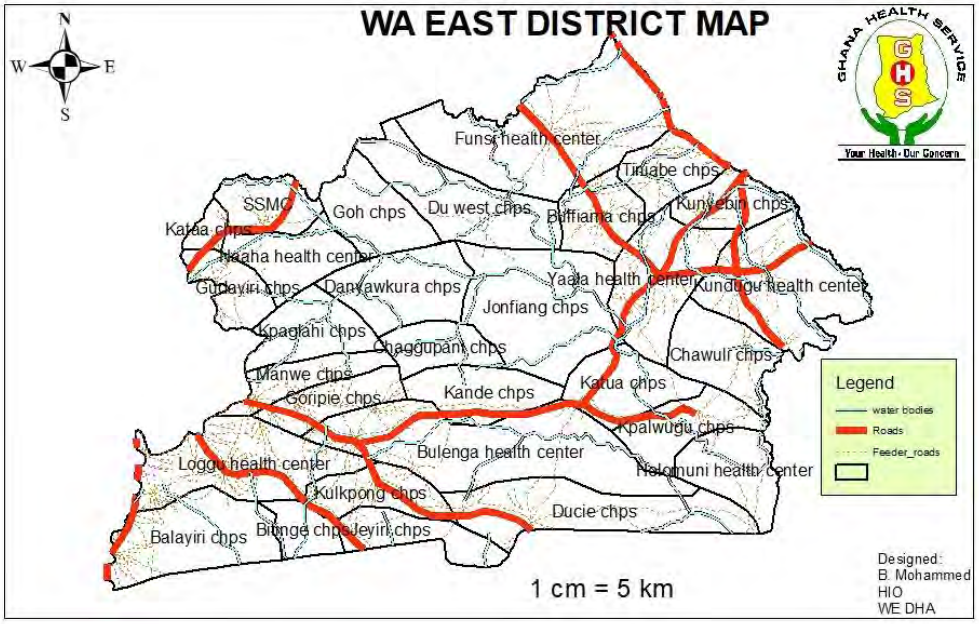

Figure 3: Map of Wa East District

3.3. Description of Study Site

3.3.1 Demographic characteristics

Wa East District has a population of 82,227 for 2017 projected from the 2010 population census figure with a growth rate of 1.9%. It is a typical farming district and is considered to be the food basket of the Upper West Region. It is a farming district and there has always been movement of people from other districts into Wa East district in search of farmlands. The capital is at Funsi, which is about 140 kilometers (KMs) away from Wa, the regional capital. It shares boundaries with seven districts: Wa Municipality to the west, Sissala East District to the North, Sissala West to the North-west, Nadowli to the West all in Upper West Region, and West Mamprusi to the South-east, West Gonja to the East and Sawla-Tuna-Kalba district to the south all in the Northern

Region. Its landmass is about 1,078km², which lies between latitudes 9º 55"N and 10º 25"N and longitude 1º 10"W and 2º 5" W. The location of the area is remote in relation to the rest of the region and characterized by low-level of development.

3.3.2 Accessibility to Healthcare facilities

The district has no hospital and patients needing hospital-level care have to access it from hospitals in other districts such as Wa Municipal, Jirapa, Kaleo or Tumu. However, there are seven health centers and twenty two (22) Community–Based Health Planning and Services (CHPS) zones, and one private health facility to serve the population.

3.4 Study Population

The study population includes all pregnant women in the Wa East district. The projected population of this targeted pregnant women in the district for 2017 was 3,289 projected from the 2010 population census data as in the Wa East district health administration profile. Thus, all pregnant women in the Wa East district will form the target population for the study.

3.5. Dependent Variable

The main outcome or dependent variable in this study is pregnant women who slept under an ITN the previous night before the survey.

3.6 Independent Variable

The primary independent variables that were measured in this study include some demographic variables such as age and ethnicity of respondents, educational status of respondent, parity, occupation, place of residence and marital status of respondents. In addition, the study measured the proportion of pregnant women who use or sleep under ITN as well as the factors that influence

the utilization of ITNs by pregnant women. Some individual and seasonal factors include: discomfort in using ITN, inadequate room space, itching, difficulty hanging the net, access to the net, size and shape of the net, the smell of net, don't like nets, rainy and dry seasonal variations. Appendix 7 shows the various variables of the study explicitly outlining and defining the variables, their scales of measurement, their operational definitions and the specific objective each measured

3.7 Inclusion Criteria

- ✓ All pregnant women who have been resident in the district for the past six (6) months
- ✓ All pregnant women who attended the randomly selected health facilities for ANC services within the period of data collection.
- ✓ All Pregnant women who were not in labor or other obstetric emergencies during the period of data collection

3.8 Exclusion Criteria

- ✓ All pregnant women who visited these randomly selected health facilities with other medical conditions or emergencies.
- ✓ All pregnant women with mental illnesses (not of sound mind) and those that cannot legally give their personal voluntary consent to be part of the study were excluded.

3.9 Sampling

3.9.1 Sample Size

Vis-à-vis other studies conducted both in Africa and Ghana on the ownership and utilization of ITNs by pregnant women and caretakers of children under five years, the average proportion of the population that used or slept under ITN a night before such studies were found to be about 47% (GDHS, 2014). Using a confidence level of 95% with a Z score of 1.96 with a 5% margin of error

(d=0.05), a minimum expected sample size of 216 which included 10% of the calculated sample to cater for refusals and non-respondents, was estimated and doubled for this study - 431. This estimated proportion of pregnant women sleeping under ITN was used as a precision because there is no such specific study conducted in the Wa East District. The formula below for single sample determination of proportions was used to arrive at the 431-sample size obtained above.

$n = (z^2 * p * q) / d^2$

Where;

- **n** = is the minimum required sample size
- **z** = is the **z** value or score for 95% confidence interval for the chosen p-value of 1.96
- **p** = is the estimated proportion of pregnant women who use or sleep under ITN in the three northern regions of Ghana which is 18.1% as indicated above
- **d** = Allowable margin of error.
- **q** = (1-p)

$n = (1.962 * 0.47 * 0.53) / 0.05^2$

$n = 196 + 10\%$

$n = 196 + 20 = 216.$

This minimum expected sample size was doubled to get 431 for this study just to improve on the results

Table 1: Sampling procedure - Proportionate distribution of sample size by health facilities.

Name of Health Facility (ANC Site)	Average Monthly Attendance	Proportionate Sample Distribution	Average Daily Sample Requirement by ANC Sites
Funsi Health Centre	100≈ (18.4%)	79	10 daily
Bulenga Health Centre	242≈(44.4%)	191	24 daily
Loggu Health Centre	138≈(25.3%)	109	14 daily
Naaha Health Centre	65≈(11.9%)	52	7 daily
Total	545(100%)	431	54 daily

Data were collected for eight (8) days, Sampling Fraction, (431/545) =0.79

3.9.2 Sampling Method

Multi-stage sampling was used as a variety of sampling techniques were employed at different stages in getting different sampling units right from the district level to the last smallest sampling unit – the respondents at the various ANC sites. At the district level, there was stratification of the district into seven (7) sub-districts to ensure that some important characteristics of the population are fairly represented. At this stage, simple random sampling through balloting without replacement was used to select four (4) health centers - sub-districts from the seven (7) strata through balloting where the names of the various sub-districts – health centers or facilities were written on pieces of paper, folded and placed in a bowl.

With one's eyes closed, a hand was dipped into the bag to pick one folded paper at a time without replacement. The facilities or sub-districts selected this way were used as the study / ANC sites where pregnant women were recruited from for the study. The simple random sampling is appropriate at this stage for selecting participating sub-districts because it gave all sub-districts equal opportunity of been selected for the study for fairness in order to avoid bias. Now, haven simply randomized four (4) sub-districts / facilities from the seven strata, the selection of the number of respondents from each sub-district health center was based on the ratio of the four (4) sub-districts' pregnant women which was obtained from data on the average daily attendance of pregnant women in each sub-district health center as indicated in table 3.1. Haven proportionately allocated the number of respondents to each facility, the selection of participant for the study was through simple random sampling using balloting with replacement where 'Yes' and 'No' responses were written on pieces of paper, folded and put in a bowl. Pregnant women who have consented to take part in this study after explaining the purpose of the study to them / after reading through the information sheet asked questions if any and appropriate explanations given, were asked to pick one of the folded ballot papers containing an option from the bowl. Those who picked "Yes" were congratulated and the questionnaire administered to them. Those who picked "No" were as well congratulated but never recruited for the study. The number of ballot papers was based on the sample size required from the particular health facility or sub-district on daily bases. Those who picked "Yes" but later on refused to take part were replaced by those who picked "No" the first time but were willing to participate. Among them, those who picked "Yes" were recruited for the study. Most importantly, pregnant women recruited on the previous day and interviewed were not included in subsequent recruitment when they happen to visit the study ANC site again on subsequent days within the period of study.

3.10 Data Collection Techniques / Methods and Tools.

This study used a structured questionnaire with closed-ended questions to collect data from the 431 participants from all the four (4) sub-districts (health centers or facilities) using face-to-face interview. The questionnaire was designed or constructed in simple English language to reflect the variables of the study and to enable easy translation by research assistants (RAs.) or data collectors. However, the questions will be asked or translated into the local dialects - Waale, Dagari, Sissali, Chakali, and Twi for better understanding especially for participants who do not have formal education during the face-to-face administration process. The questions in the questionnaire covered some vital demographic characteristics of respondents, usage of ITN the night to the study, seasonal influence on ITN use and other personal factors that influence pregnant women on the use of ITN. The tool was pretested among ten (10) pregnant women each attending antenatal clinic in Wa Municipal urban center and Siriyiri CHPS in the Wa West districts where ambiguities vis-à-vis framing and asking of questions were corrected to reflect the objectives of the study while ensuring that accurate information is provided by participants.

3.11 Data collection procedure.

The data was purely collected by four (4) research assistants and the principal investigator (PI) across the four ANC study sites on daily basis for a period of eight (8) days where a minimum of seven (7) and a maximum of twenty four (24) questionnaires were administered as scheduled by facilities in Table 3.1. A day's training was organized for the four (4) research assistants (RAs.) - data collectors, facilitated by the principal investigator, where the research assistants (RAs) were taken through the various sections of the questionnaire or tool stressing on appropriate questioning techniques and how to elicit responses from respondents. It was also interpreted in the local dialects to enable research assistants (RAs) to ask the right questions.

The research assistants were also sensitized on issues of privacy and confidentiality, consent seeking before the interview and how to politely ask questions in the questionnaire. Their training session was rounded up with field practical where the tool was pretested among ten (10) pregnant women each attending antenatal clinic in Wa Municipal urban center and Siriyiri CHPS in the Wa west districts so that ambiguities vis-à-vis framing and asking of questions could be corrected to reflect the objectives of the study and to ensure that accurate information is provided by participants. Haven polished the accuracy and validity of the questionnaire with inputs from the pre-tested questions, a formal introductory letter from the school of public health and the ethical clearance the researcher obtained from the Ghana Health Service Ethical Review Committee referenced GHS/RDD/ERC/Admin/App/815 with registration number: GHS-ERC:038/12/17 was attached to a written application by the principal investigator to the Wa East District Director of Health Services (DDHS) through the district health administrator seeking their approval for data to be collected from participants at the randomized health facilities within their district. This formally introduced the principal researcher to the management of the district. A cover letter from the DDHS was then attached to the above research credential documents and in the company of the RAs, these were self-delivered to the sub-district in-charges of the various four (4) study health facilities introducing ourselves and the purpose of the study to the in-charges and their staff as protocol demands. At the various specific ANC sites where, primary data was collected from participants, the PI again introduced his team of RAs and the purpose of the study to the staff there, showing the supporting documents. The purpose of the study was explained to participants and each eligible goes through the sampling procedure as described in the sampling method in section 3.6.2 where eligible and consented participants were interviewed.

3.12 Quality Control

The tool was pretested among ten (10) pregnant women each attending antenatal clinic in Wa Municipal urban center and Siriyiri CHPS in the Wa West districts so that ambiguities vis-à-vis framing and asking of questions could be corrected to reflect the objectives of the study and to ensure that accurate information is provided by participants. All the questionnaires were coded for uniqueness so that each could be traced at any level and fished out to effect any changes or corrections. Questionnaires send in by research assistants on daily basis were cross-checked, scrutinized and validated by the principal investigator for any duplications, wrong recordings, incompleteness, omissions, outliers, poor recordings among others and identified errors were there and then discussed with the research assistants and those found to be incomplete given back to them to be sent to the field to correct. The services of two data entry officers were solicited and engaged to key in the cleaned and validated data both into Microsoft Excel 2013 and IBM SPSS version 21.0

3.12.1 Pretest

For the purpose of the validity of the instrument that was used for the study, the questionnaire was constructed and given to other researchers and the academic Supervisor to peruse. Suggestions from these experts helped the investigator modify and streamlined the questionnaire appropriately that met standards and valid, in suitably measuring the objectives the investigator intends to measure.

The questionnaires were pretested a week before the actual start of this study among ten (10) pregnant women each attending antenatal clinic in Wa Municipal urban health center and Siriyiri CHPS zone in the Wa west districts of the upper west region. These facilities were not in the study area but shared commonality characteristics with the selected facilities in the Wa East district.

These facilities were used for the pretesting to avoid cross-contamination. Appendix 4 is a copy of the questionnaire.

3.13 Data Processing and Analysis.

Raw data from the field after it has been manually cross-checked to ensure completeness were keyed into both Microsoft Excel 2013 and IBM SPSS version 21 before been exported to STATA version 15 for analysis. To ensure accuracy and completeness, the data was further cleaned by running frequencies of all variables to check for incorrect coding using STATA version 15. The number of pregnant women that used ITNs was reported as a proportion**.** Basic descriptive statistics were performed on the background characteristics of respondents and the results presented in frequencies and percentages using tables and charts. Frequencies were generated to describe the distribution covariates and the utilization of ITNs by pregnant women while continuous variables were expressed as arithmetic means and standard deviations. The researcher used Pearson's chi-square test to compare proportions. Bivariate analysis was employed to assess the crude association between potential predictors and the utilization of ITNs whilst multiple logistic regression was performed to estimate the associations between the dependent variable and each independent variable after controlling for other covariates. The strength of associations detected by the tests and analysis were reported as odds ratios as the study is a cross-sectional design. The statistical significance was set at $p<0.05$ for all analyses.

3.14 Statistical methods.

Pearson's chi-square test was used to compare proportions whilst bivariate analysis was done to assess the crude association between potential predictors and the utilization of ITNs whereas multiple logistic regression was performed to estimate the associations between the dependent variable and each independent variable after controlling for the other covariates as indicated in section 3.10.

3.15 Ethical Considerations and human subject issues.

Ethical clearance was first obtained from the Ghana Health Service Ethical Review Committee (GHS-ERC) through the School of Public Health (SPH) – University of Ghana (UG) prior to the commencement of the study with protocol number GHS-ERC: 038/12/17. Permission and approval was also sought from the Wa East District Health Directorate through the District Director of Health Services (DDHS) by applying to the District Director of Health Services (DDHS) for administrative permission and approval attaching the introductory letter from my Head of Department – Epidemiology and Disease Control, of the SPH-UG as per attached and the Ghana Health Service Ethical Review Committee (GHS-ERC) clearance or approval certificate or letter, introducing me for acceptance and permission to commence the study in the district. A permission or introductory letter from the DDHS was obtained and sent to all heads of facilities (in-charges) as well as ANC unit heads at the various study health facilities to introduce me buttressing my identity and purpose as a researcher to work in their facilities. Consent was also sought from male partners that accompanied their pregnant wives to the ANC sites before they were recruited for the study after the purpose have been explicitly explained to the couple. Participation was purely voluntary and the decision to participate depends on the individual. Participants were informed that they could refuse to participate in the study or withdraw from the study at any time in the course of the interview, or choose to ignore or skip any question that they find uncomfortable answering, but were entreated to be patient to complete the study once the process has started. It was clearly made known to participants that refusal to participate in the study or withdrawal from the study would not be a reason for any compromised quality of care on the day of the interview or afterward as all will still receive the best possible quality of care.

The objectives of the study were clearly explained to each participant and their informed consent sought before they answered the questions. Participants who only consented to participate in the study were given consent form to sign or thumbprint before they will be interviewed.

Appendix 1 and 2 are copies of the information sheet and informed consent form that explicitly gave a general information about the study, its procedure, possible risks or discomforts if any, its potential benefits, issues on voluntariness and the right to refuse the study, confidentiality, participant rights' issues and contact information of the principal investigator, his academic supervisor and the Ghana Health Service – Ethical Review Committee of the Research and Development Division contact persons for the purpose of checking the credibility of the study.

The interviews were conducted on a one-on-one basis in an environment that was free from distractions while ensuring the privacy of participants. Confidentiality of data collected was ensured by using unique identifiers (codes) rather than names of participants and the participants were assured that the data collected would only be used for academic purposes. Participants were assured that apart from those involved in this study such as the research assistants, the principal investigator and probably, the supervisor, no other party would have access to the data collected from participants without the consent of the participants. Completed questionnaires from the study are in the possession of the PI under lock and would not be accessed by unauthorized personnel. Computer files from the study were password protected to avoid unauthorized access as well.

These data files would only be disposed of after the research findings or results are finalized and possibly published. There was no tangible reward of any kind for participants and this was clearly explained to participants at the recruitment stage of the study. The administration of the questionnaire had a mean time of thirty (30) minutes per participant and they were clearly told this before the start of each interview session. Findings of the study would be made known to the respondents through the feedback that was given to the DDHS for onward forwarding to the various sub-

districts' and ANC site in-charges concerned, to be delivered to the participants during their subsequent visits to such facilities. Other medium of dissemination would be through community durbars, meetings and CWC sessions in these communities with the support of the in-charges and health promotion officers of the district. The PI had no conflict of interest regarding the conduct of the study and the study was solely financed by the principal investigator.

3.16 Sources of data

Both primary and secondary sources of data were made use of in this study. Primary data was basically sourced from the field survey whereas major secondary data were sourced through an extensive search for data and information from the Wa East district health directorate, countless libraries, and the web or internet at large.

CHAPTER FOUR

RESULTS

4.1 Background Characteristics of Respondents.

All the 431 pregnant women who were invited to participate in the study consented and completed the interviews (100% response rate). The median age of respondents was 28 years (range: 19 to 49). About 49.2% (212/431) were in the age of 20 to 29-year age group with 7.9% (34/431) of the respondents aged below 20 years. Majority of the respondents 78.4% (334/431) were married (Table 2). More than half of the respondents 61.5% (265/431) were muslims. Waalas constituted 48.7% (210/431) of the study participants. Most of the respondents 37.6% (162/431) had no formal education while 17.6% (76/431) had secondary education and 14.1% (61/431) had tertiary education. Almost one-third of the respondents 31.8% (137/431) were farmers, 13.4% (38/431) were government employed while 12% (35/431) were students. However, 7.0% (30/431) reported as business women. The mean parity of respondents was 2.1 ± 1.6 with para 0, 1, 2, 3 each constituting about one-fifth of the study population with 10.4% (45/431) reporting as para 4. Two third of the respondents 68.0% (293/431) were resident in towns with the other one third 32.0% (138/431) resident in rural settings. Most of the respondents 25.7% (111/431) shared their sleeping places with two other persons with 10.4% (45/431) sleeping alone and 10.9% (47/431) sleeping with five other persons (Table 2).

Table 2: Socio-demographic characteristics of pregnant women in the Wa East district, January 2018.

Variable	Number of respondents (N=431)	Proportion (%)
Age of Respondents (years)		
<20	34	7.9
20 – 29	212	49.2
30 – 39	142	32.9
40 – 49	43	10.0
Marital Status of Respondents		
Single	70	16.3
Married	338	78.4
Cohabiting	6	1.4
Divorced	10	2.3
Widowed	7	1.6
Religious Affiliation of Respondent		
Christianity	158	36.7
Islam	265	61.5
Traditional African Religion	8	1.8
Ethnicity of Respondent		
Sissala	96	22.3
Waala	210	48.7
Dagao	88	20.4
Chakalu	12	2.9
Akan	20	4.6
Others	5	1.2
Highest Educational Level		
No Formal Education	177	41.1
Basic (BECE)	117	27.2
Secondary	76	17.6
Tertiary	61	14.1

Occupational Status of Respondent		
Unemployed / House-wife	104	24.1
Farming	137	31.8
Seamstress and Hairdressing	47	10.9
Business Woman (Buying and Selling)	30	7.0
Government Employed	58	13.4
Student	55	12.8
Parity of Respondent	Mean=2.11, SD±1.63	
0	91	21.1
1	86	20.0
2	83	19.2
3	77	18.0
4	45	10.4
≥5	49	11.3
Place of Residence		
Town	293	68.0
Rural	138	32.0
Number of persons in room		
Sleeps alone	45	10.4
Shares room with 1 other person	99	23.0
Shares room with 2 other person	111	25.7
Shares room with 3 other persons	68	15.8
Shares room with 4 other persons	61	14.2
Shares room with 5 & above people	47	10.9

4.2 Awareness and ownership of ITN by respondents.

Almost all of the respondents 97.4% (420/431) reported having ever heard of ITN. Majority 84.2% (363/431) reported having owned at least one ITN with a mean of 0.9 ± 0.94. Most of the respondents 150(41.3%) reported having two ITNs while 7(2%) had five and above ITNs. About nine of every ten respondents 91.2% (393/431) reported that sleeping under an ITN can protect

one from getting malaria infection. About a quarter 24.1% (104/431) of the respondents could not remember the last time the used or slept under an ITN while 137(31.8%) indicated the last rainy season to be the last time the slept under an ITN (Table 4).

4.3 Proportion of Respondents who used ITN.

Less than half 44.0% of the respondents used an ITN the previous night to the study (Figure 2).

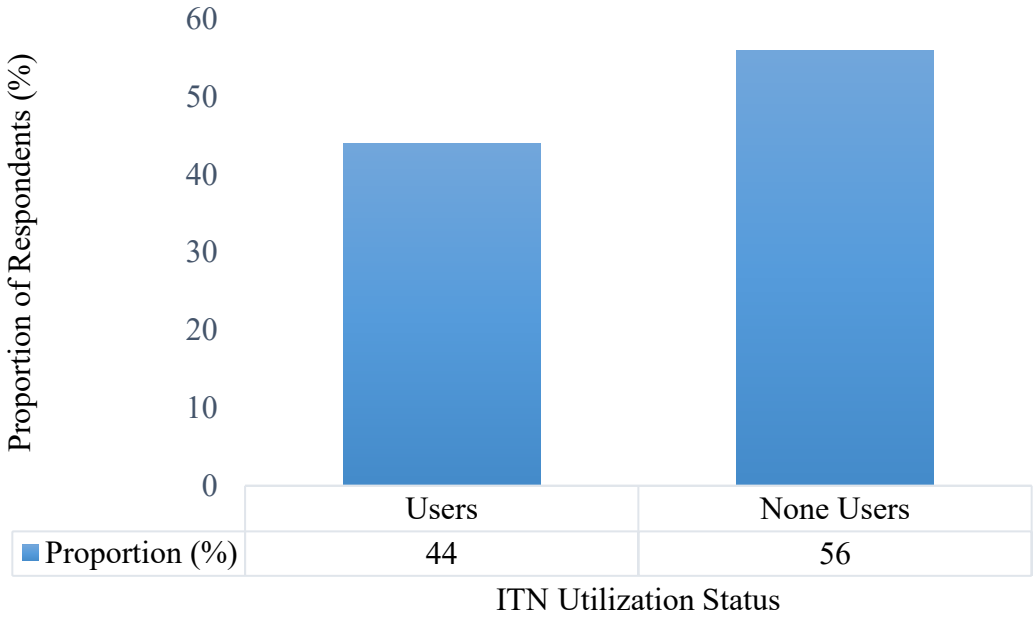

Figure 4: Proportion of pregnant women who used an ITN in the Wa East district, January 2018.

More than half of the respondents enrolled in this study 56.0% (241/431) did not use or sleep under an ITN the previous night to the study with 44.0% of them reported to have used/slept under an ITN the night to the study.

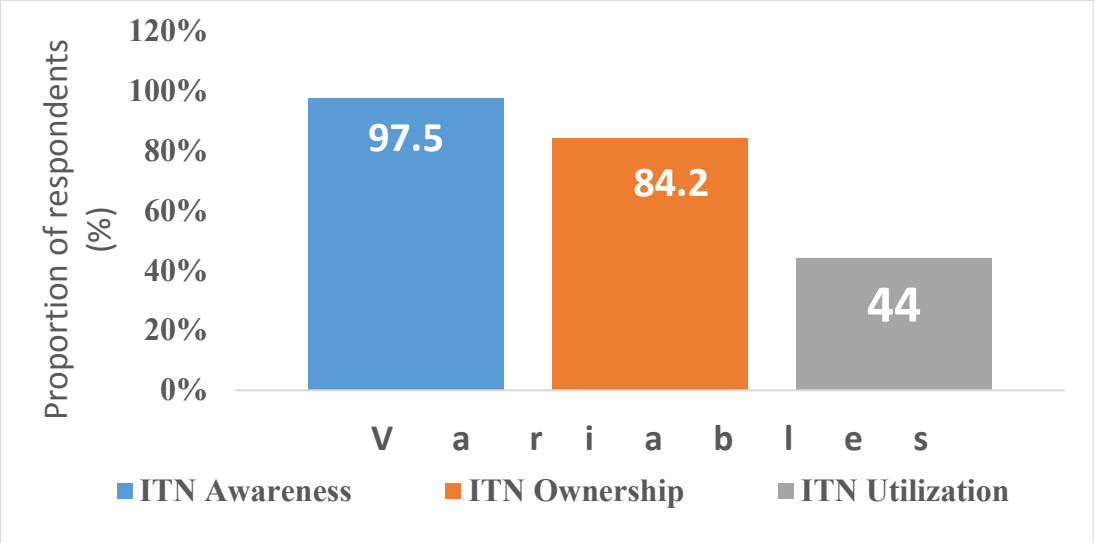

Figure 5: Awareness, ownership, and utilization coverages on ITN among pregnant women in Wa East district, January 2018.

Almost all the respondent 97.5% (420/431) reported to have ever heard of ITN, 84.0% (363/431) owning ITNs with 44.0% using their ITNs the night to the study.

Table 3: Distribution of pregnant women by ITN Ownership and Utilization in Wa East district, January 2018.

Variable	Frequency, N=431	Proportion (%)
Respondent Ever Heard of ITN Before		
No	11	2.6
Yes	420	97.4
Ownership of ITN by Respondents		
No	68	15.8
Yes	363	84.2
Number of ITNs Owned by Respondents	Mean=0.90, SD=±0.94	
1 ITN	140	38.5
2 ITNs	150	41.3
3 ITNs	48	13.2
4 ITNs	18	5.0
5 and Above ITNs	7	2.0
Sleeping under ITN Protects Against Malaria Infection		
Strongly disagree	20	4.6
Disagree	18	4.2
Agree	274	63.6
Strongly Agree	119	27.6
Last Time Respondent Slept Under an ITN		
Can't Remember	104	24.1
Last Night	190	44.1
The last rainy season	137	31.8
Respondents' Use of ITN the Previous Night Before the Interview or Survey		
None users	241	56.0
Users	190	44.0

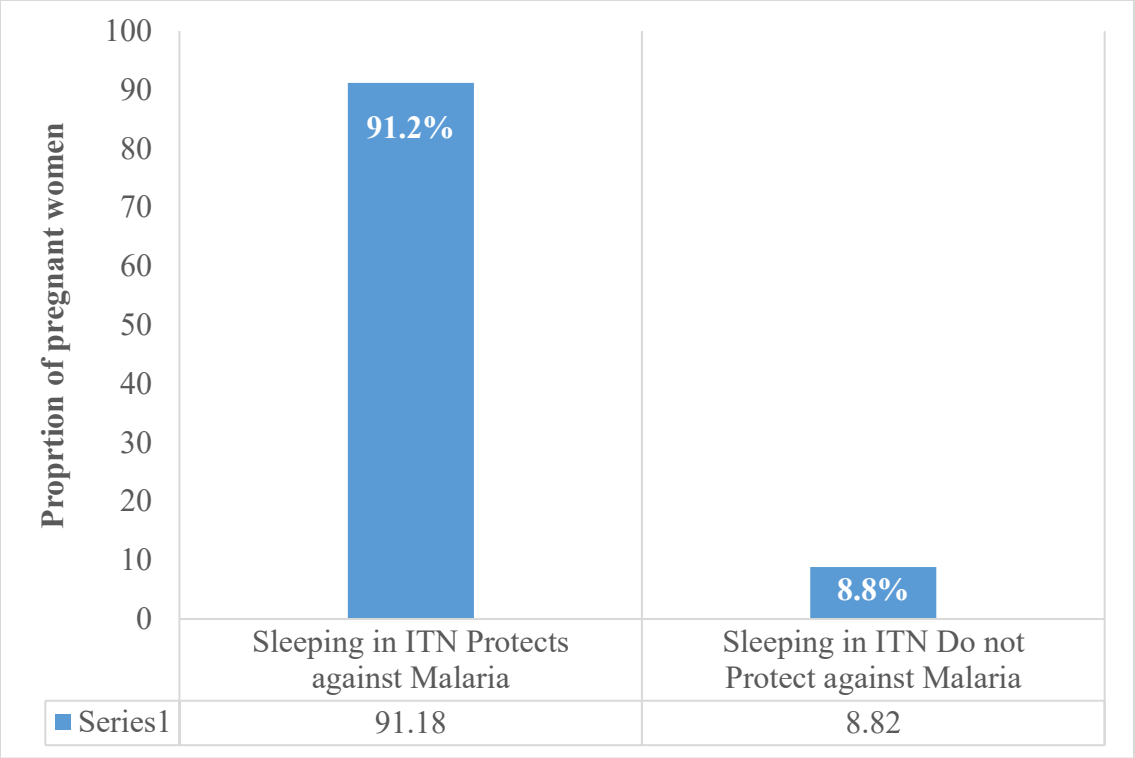

Figure 6: Proportion of pregnant women who knew that sleeping under ITN protects against malaria infection in Wa East district, January 2018.

Majority 91.2% (393/431) of the respondents knew and agree that sleeping under an ITN protects one against malaria infection whereas 8.8% (38/431) disagreed with this.

4.4 Seasonal influence on ITN utilization by respondents.

Majority 71.2% reported they are most likely to use or sleep under an ITN during the rainy season while 3.5% indicated they are most likely to use an ITNs in the dry season with 21.6% indicating they were most likely to use their ITNs throughout the year while 3.7% of them never used an ITN before as shown in Figure 6.

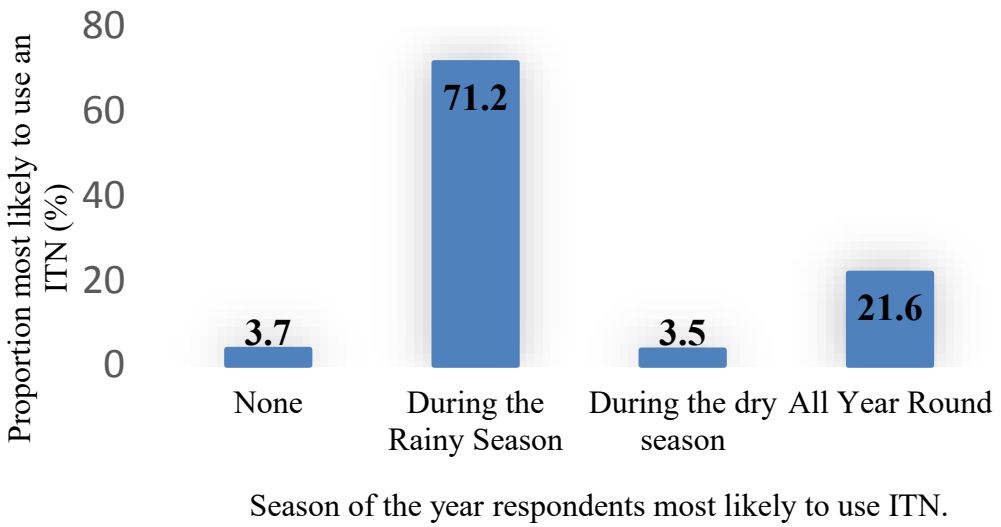

Figure 7: Distribution of respondents' likelihood to use an ITN by season in Wa East district, January 2018.

4.5 Other related factors influencing respondents' use of ITNs

More than half 58.7% (253/431) of the respondents reported that the chemicals used in treating ITNs itch their skin when they use or sleep under ITN. Discomfort (heat, warmth, and sweating) was reported among 56.1% (242/431) of the pregnant women while 27.6% (119/431) indicated their rooms were small for an ITN to be hanged. Also, 29.9% (129/431) shared their rooms with too many people 36.9% (159/431) used mosquito spray/ coil/repellent whilst 23.4% (101/431) reported there were no mosquitoes in their localities or rooms. More than a quarter 30.9% (133/431) reported they find it difficult and stressful hanging an ITN for use (Table 5).

Table 4: Frequency distribution of individual factors of pregnant women in Wa East district, January 2018.

Variable – Individual factors	Frequency (N=431)	Proportion (%)
Chemical on ITN itches skin		
No, chemical do not itch skin	178	41.3
Yes, chemical itches skin	253	58.7
Sleeping under ITN causes discomfort (heat, warmth & sweat)		
No discomfort, heat/warmth	189	43.9
Yes, discomfortable with heat & warmth	242	56.1
Inadequate or Small room space to hang ITN		
No, have a large room	312	72.4
Yes, small sleeping space	119	27.6
Share room with too many people		
No	302	70.1
Yes	129	29.9
ITN thorn beyond maintenance or sewing		
No, ITN not thorn	367	85.1
Yes, ITN thorn	64	14.9
Don't have an ITN		
No, have an ITN	363	84.2
Yes, no ITN	68	15.8
Difficulty & Stress in Hanging ITN		
Not difficult nor stressful hanging ITN	298	69.1
Yes, difficult & stressful to hang ITN	133	30.9
Perception of low mosquitoes population density in the locality		
Mosquitoes present	330	76.6
No Mosquitoes	101	23.4
Use of Mosquito Spray, Coils & Repellent by Respondent		

No, do not use any	272	63.1
Yes, use Mosquito spray	159	36.9
Respondents' Breathing Difficulty under an ITN		
No difficulty Breathing under an ITN	352	81.7
Yes, difficult Breathing under an ITN	79	18.3

Source: field data

4.6 Comparing respondents who used ITN to those who did not use ITN the previous night **to the study.**

Most of the respondents, 50% (71/142) who used ITN were aged 30-39 years while 48.8% (21/43) were aged 40-49 years. Among the divorced respondent, 50% (5/10) used ITN while only 28.6% of the widowed respondents reported to have used an ITN. Majority of the traditionalists, 62.5% indicated to have used ITN with no difference observed in ITN utilization between muslims and christians – 43.8% each. Majority of the Chakalu tribe 66.7% reported using an ITN with the Akan tribe leading with 65% non-utilization of ITN. It was also revealed that a higher number of respondents 37.6% had no formal education at all, out of which 41.4% reported to have used ITN the previous night. Majority of the respondents 31.8% were farmers out of which 44.5% indicated to have used ITN the previous night to the study. There was no difference in ITN utilization among students and other business women in the study as 53.3% of each category used their ITNs. One-fifth 21.1% of the respondents had no child at the time of the study out of which more than half 52.8% reported using ITN. Table 5 gives a detailed picture of the description.

Table 5: Comparing pregnant women who used ITN to those who did not use ITN in the Wa East district, January 2018.

Variable	Number of Respondents N=431(%)	ITN Utilization status of respondents	
		Users- n=190(%)	Non-Users n=241(%)
Age of Respondent (Years)			
<20	34(7.9)	9(26.5)	25 (73.5)
20 – 29	212(49.1)	89(42.0)	123(58.0)
30 – 39	142(33.0)	71(50.0)	71(50.0)
40 -49	43(10.0)	21(48.8)	22(51.2)
Marital Status of Respondents			
Single	70(16.2)	33(47.1)	37(52.9)
Married	338(78.4)	148(43.8)	190(56.2)
Cohabiting	6(1.4)	2(33.3)	4(66.7)
Divorced	10(2.3)	5(50.0)	5(50.0)
Widowed	7(1.7)	2(28.6)	5(71.4)
Religious Affiliation			
Christian	158(36.7)	69(43.7)	89(56.3)
Islam	265(61.4)	116(43.8)	149(56.2)
Traditional African Religion (TAR)	8(1.9)	5(62.5)	3(37.50)
Ethnicity			
Sissala	96(22.3)	42(43.8)	54(56.2)
Waala	210(48.7)	81(38.6)	129(61.4)
Dagao	88(20.4)	49(55.7)	39(44.3)
Chakalu	12(2.3)	8(66.7)	4(33.3)
Akan	20(4.6)	7(35.0)	13(65.0)
Others	5(1.2)	3(60.0)	2(40.0)
Highest Educational Level			
No Formal Education	177(41.1)	78(44.1)	99(55.9)

Basic Level (BECE)	117(27.1)	49(41.9)	68(58.1)
Secondary Level (SSCE)	76(17.6)	36(47.4)	40(52.6)
Tertiary	61(14.2)	27(44.3)	34(55.7)
Occupation of Respondents			
Unemployed (House wife)	104(24.1)	35(33.7)	69(66.3)
Farming	137(31.8)	61(44.5)	76(55.5)
Seamstress	47(10.9)	24(51.1)	23(48.9)
Business (Buying & Selling)	30(7.0)	16(53.3)	14(46.7)
Government Employed	58(13.4)	25(43.1)	33(56.9)
Student	55(12.8)	29(52.7)	26(47.3)
Parity			
0	91(21.1)	48(52.8)	43(47.2)
1	86(20.0)	36(41.9)	50(58.1)
2	83(19.3)	37(44.6)	46(55.4)
3	77(17.9)	28(36.4)	49(63.6)
4	45(10.4)	21(46.7)	24(53.3)
5+	**49(11.3)**	**20(40.8)**	**29(59.2)**

Out of the majority, 68% (293/431) of the respondents living in town settings, 39.3% (115/293) of them used ITNs. More than half 54.3% (75/138) of those living in rural areas reported to have used ITNs. Out of the majority, 25.8% of respondents who reported to be sharing their rooms with two other persons, 45.1% used their ITNs while a higher proportion of 54.1% of those sharing their rooms with four other persons used their ITNs. Majority of the respondents, 97.5% (420/431) who have ever heard of ITN, and 45.2% used their ITNs whereas none of those who never heard of ITN utilized it. Out of a higher proportion of respondents 84.2% (363/431) who owned at least one ITN, 49% (178/363) of them used their ITNs. Most of the respondents 41.3% owned two ITNs,

out of which 44% used them whereas 85.7% of respondents who owned five and above ITNs slept under an ITN. Although majority of the respondents 91.2% (393/431) reported that sleeping under an ITN can protect one from malaria infection, 46% (179/393) indicated they used their ITNs in the study. Again, out of a higher proportion 71.2% (307/431) who reported that they are most likely to use an ITN in the rainy season, 33.2% (102/307) indicated they used their ITNs in the study with 91.4% (85/93) of those who indicated they used their ITNs all year round using an ITN in the study.

Table 6: Comparing pregnant women who used ITN to those who did not use ITN in the Wa East district, January 2018.

Variable	Number of Respondents N=431 (%)	ITN Utilization status of respondents	
		Users n=190 (%)	Non-Users n=241 (%)
Place of residence			
Town	293(68.0)	115(39.3)	178(60.7)
Rural	138(32.0)	75(54.3)	63(45.7)
Share room with others			
Sleeps alone	45(10.4)	18(40.0)	27(60.0)
Sleeps with 1 person	99(23.0)	41(41,4)	58(58.6)
Sleeps with 2 persons	111(25.8	50(45.1)	61(54.9)
Sleeps with 3 persons	68(15.8)	21(30.9)	47(69.1)
Sleeps with 4 persons	61(14.1)	33(54.1)	28(45.9)
Sleeps with ≥5 persons	47(11.0)	27(57.5)	20(42.5)
Heard of ITN			
No	11(2.5)	0(0.0)	11(100.0)
Yes	420(97.5)	190(45.2)	230(54.8)
Ownership of ITN			
No	68(15.8)	12(17.7)	56(82,3)
Yes	363(84.2)	178(49.0)	185(51)

Number of ITNs owned			
1 ITN	140(38.5)	67(47.9)	73(52.1)
2 ITNs	150(41.3)	66(44.0)	84(56.0)
3 ITNs	48(13.2)	26(54.1)	22(45.9)
4 ITNs	18(5.0)	13(72.2)	5(27.8)
≥5 ITNs	7(2.0)	6(85.7)	1(14.3)
Sleeping under ITN can protect against malaria infection			
Yes, it protects	393(91.2)	179(46)	214(54.0)
No, it does not protect	38(8.8)	11(29.0)	27(71.0)
Season of year most likely to use ITN			
Never	16(3.8)	1(6.2)	15(93.8)
During the rainy season	307(71.2)	102(33.2)	205(66.8)
During the dry season	15(3.5)	2(13.3)	13(86.7)
All year round	93(21.5)	85(91.4)	8(8.6)

More than half of the respondents 58.7% (253/431) who reported that the chemicals used in treating ITNs itch their skin, less than half 46.3% (117/253) reported in the study to have used an ITN. There was no difference observed in ITN utilization among respondents who indicated they had discomfort and those that were comfortable using an ITN. Among those who had adequate/large sleeping rooms 72.4% (312/431) to tie ITN, 42% (131/312) reported to have used their ITNs. Majority of the respondents 85.1% (367/431), who had their ITNs in good shape (not thorn), 46% (169/367) used their ITNs. Out of a higher proportion, 76.6% (330/431) of the respondents who reported that mosquitoes' population densities were low in their localities/rooms, 51.5% (170/330) indicated they used their ITNs. Also, out of the majority 81.7% (352/431) who reported having no difficulty breathing under an ITN, 42.9% (151/352) of them used their ITNs in the study.

Table 7: Comparing respondents' individual factors associated with ITN utilization among pregnant women in the Wa East district, January 2018.

Variable	Number of Respondents – N=431 (%)	ITN Utilization status of respondents	
		Users=190 (%)	Non-Users=241 (%)
Chemical on ITN itches skin			
No, doesn't itch skin	178(41.3)	73(41.0)	105(59)
Yes, it itches skin	253(58.7)	117(46.3)	136(53.7)
Discomfort (heat, warmth, sweats) sleeping under ITN			
No discomfort	189(43.9)	83(44.0)	106(56.0)
Yes, is discomfortable	242(56.1)	107(44.2)	135(55.8)
Inadequate/small sleeping space			
No, had adequate room size	312(72.4)	131(42.0)	181(58.0)
Yes, room too small	119(27.6)	59(50.0)	60(50.0)
Share room with many people			
No, with just 2 others	302(70.0)	131(43.4)	171(56.6)
Yes, with 2+ people	129(30.0)	59(45.7)	70(54.3)
ITN thorn beyond repairs			
No	367(85.1)	169(46.0)	198(54.0)
Yes	64(14.9)	21(33.0)	43(67.0)
Difficult/stressful hanging ITN			
No, not difficult	298(69.1)	127(42.6)	171(57.4)
Yes, is difficult	133(30.9)	63(47.4)	70(52.6)
Perception of low mosquitoes' population density in the locality			
No, mosquitoes exist	330(76.6)	170(51.5)	160(48.5)
Yes, no mosquitoes	101(23.4)	20(19.8)	81(80.2)
Use mosquito spray, coil & repellent			
No	272(63.1)	124(45.6)	148(54.4)
Yes	159(36.9)	66(41.5)	93(58.5)

Difficulty breathing under ITN			
No, breaths normally	352(81.7)	151(42.9)	201(57.1)
Yes, difficult breathing	79(18.3)	39(49.4)	40(50.6)

4.7 Demographic factors influencing ITN utilization among pregnant women.

Findings from this study as detailed in Table 9 revealed that ethnicity was significantly associated with ITN utilization. It indicated that 48.7% (210/431) of the respondents who were Waalas, 38.6% (81/210) of them used their ITNs in the study while majority of the Chakali people reported to have used their ITNs.

Table 8: Demographic factors associated with ITN utilization among pregnant women in the Wa East district, January 2018.

Variable	Number of Respondents N=431(%)	ITN Utilization status		χ^2	p-value
		Users190 (%)	Non-Users=241 (%)		
Age of Respondent (Years)				7.07	0.070
<20	34(7.9)	9(26.47)	25 (73.53)		
20 – 29	212(49.1)	89(41.98)	123(58.02		
30 – 39	142(33.0)	71(50.0)	71(50.0)		
40 -49	43(10.0)	21(48.84)	22(51.16)		
Marital Status of Respondents				1.38	0.847
Single	70(16.2)	33(47.14)	37(52.86)		
Married	338(78.4)	148(43.79)	190(56.21)		
Cohabiting	6(1.4)	2(33.33)	4(66.67)		
Divorced	10(2.3)	5(50.0)	5(50.0)		
Widowed	7(1.7)	2(28.57)	5(71.43)		
Religious Affiliation				1.12	0.571
Christian	158(36.7)	69(43.7)	89(56.3)		
Islam	265(61.4)	116(43.8)	149(56.2)		
Traditional African Religion (TAR)	8(1.9)	5(62.5)	3(37.50)		
Ethnicity				11.06	0.050*
Sissala	96(22.3)	42(43.8)	54(56.2)		
Waala	210(48.7)	81(38.6)	129(61.4)		
Dagao	88(20.4)	49(55.7)	39(44.3)		
Chakalu	12(2.3)	8(66.7)	4(33.3)		
Akan	20(4.6)	7(35.0)	13(65.0)		
Others	5(1.2)	3(60.0)	2(40.0)		

Highest Educational Level				6.26	0.181
No Formal Education	177(41.1)	78(44.1)	99(55.9)		
Basic Level (BECE)	117(27.1)	49(41.9)	68(58.1)		
Secondary Level (SSCE)	76(17.6)	36(47.4)	40(52.6)		
Tertiary	61(14.2)	27(44.3)	34(55.7)		
Occupation of Respondents				8.26	0.142
Unemployed (House wife)	104(24.1)	35(33.7)	69(66.3)		
Farming	137(31.8)	61(44.5)	76(55.5)		
Seamstress	47(10.9)	24(51.1)	23(48.9)		
Business (Buying & Selling)	30(7.0)	16(53.3)	14(46.7)		
Government Employed	58(13.4)	25(43.1)	33(56.9)		
Student	55(12.8)	29(52.7)	26(47.3)		
Parity				5.15	0.39
0	91(21.1)	48(52.8)	43(47.2)		
1	86(20.0)	36(41.9)	50(58.1)		
2	83(19.3)	37(44.6)	46(55.4)		
3	77(17.9)	28(36.4)	49(63.6)		
4	45(10.4)	21(46.7)	24(53.3)		
5+	49(11.3)	20(40.8)	29(59.2)		

*=$p<0.05$

Source: Field data

4.8: Other related factors associated with ITN utilization among pregnant women.

A higher number of respondents 54.3% (75/138), who reported to have used an ITN in the study were from rural areas although majority of the study respondents 68% (293/431) were in towns. One's place of residence was found to be significantly associated with ITN utilization. The number of persons one share room with was also associated with ITN utilization. Few respondents 10.4% (45/431) that were sleeping all alone in their rooms, two-fifth, 40% (18/45) reported to have used their ITN in the study. Majority of the respondents who used ITNs in the study were among those sharing their rooms with five and above people. Respondents who have ever heard of ITN were seen more likely to use an ITN than their counterparts who have never heard of ITN before. Ownership of ITN was significantly related to ITN utilization. Majority of respondents who owned ITNs, 84.2% seem to have used ITN more in the study (49%). The number of ITNs owned was also associated with ITN utilization. Though less number of respondents, 2% had five and above ITNs, majority of them, 85.7% reported using their ITNs in the study. Respondents who indicated they use their ITNs all year round (21.5%), majority 91.4% used ITNs in the study (Table 10). The season of the year was also significantly related to ITN utilization.

Table 9: Other related factors associated with ITN utilization among pregnant women in the Wa East district, January 2018.

Variable	Number of Respondents N=431 (%)	ITN Utilization status		χ^2	p-value
		Users190 (%)	Non-Users=241 (%)		
Place of residence				8.68	0.003*
Town	293(68.0)	115(39.3)	178(60.7)		
Rural	138(32.0)	75(54.3)	63(45.7)		
Share room with others				11.33	0.045*
Sleeps alone	45(10.4)	18(40.0)	27(60.0)		
Sleeps with 1 person	99(23.0)	41(41,4)	58(58.6)		
Sleeps with 2 persons	111(25.8	50(45.1)	61(54.9)		
Sleeps with 3 persons	68(15.8)	21(30.9)	47(69.1)		
Sleeps with 4 persons	61(14.1)	33(54.1)	28(45.9)		
Sleeps with ≥5 persons	47(11.0)	27(57.5)	20(42.5)		
Heard of ITN				8.89	0.003*
No	11(2.5)	0(0.0)	11(100.0)		
Yes	420(97.5)	190(45.2)	230(54.8)		
Ownership of ITN				22.89	<0.0001*
No	68(15.8)	12(17.7)	56(82,3)		
Yes	363(84.2)	178(49.0)	185(51)		
Number of ITNs owned				9.75	0.045*
1 ITN	140(38.5)	67(47.9)	73(52.1)		
2 ITNs	150(41.3)	66(44.0)	84(56.0)		
3 ITNs	48(13.2)	26(54.1)	22(45.9)		
4 ITNs	18(5.0)	13(72.2)	5(27.8)		
≥5 ITNs	7(2.0)	6(85.7)	1(14.3)		
Sleeping under ITN can protect against malaria infection				3.87	0.045*

No, it does not protect	393(91.2)	179(46)	214(54.0)		
Yes, it protects	38(8.8)	11(29.0)	27(71.0)		
Season of year most likely to use ITN				114.19	<0.0001*
None	16(3.8)	1(6.2)	15(93.8)		
During the rainy season	307(71.2)	102(33.2)	205(66.8)		
During the dry season	15(3.5)	2(13.3)	13(86.7)		
All year round	93(21.5)	85(91.4)	8(8.6)		

*=p<0.05

4.9 Factors associated with ITN utilization among pregnant women.

One-third of the respondents 33% (21/64), who's ITNs were thorn still used them in the study. Thorn ITN was found to have a significant association with ITN utilization. Out of a significant number of respondents who admitted mosquitoes density is high in their localities and rooms 76.7% 330/431), about one-fifth 19.8% (20/101) of them used their ITNs in the study. And there seems to be a significant association between perception of low mosquito's population density in one's locality and the use of ITN as detailed in Table 10.

Table 10: Factors associated with ITN utilization among pregnant women in Wa East district, January 2018.

Variable	Number of Respondents N=431 (%)	ITN Utilization status		χ^2	p-value
		Users190 (%)	Non-Users=241 (%)		
Chemical on ITN itches skin				1.16	0.281
No, doesn't itch skin	178(41.3)	73(41.0)	105(59)		
Yes, it itches skin	253(58.7)	117(46.3)	136(53.7)		
Discomfort (heat, warmth, sweats) sleeping under ITN				0.004	0.950
No discomfort	189(43.9)	83(44.0)	106(56.0)		
Yes, is discomfortable	242(56.1)	107(44.2)	135(55.8)		
Inadequate/small sleeping space				2.01	0.156
No, had adequate room size	312(72.4)	131(42.0)	181(58.0)		
Yes, room too small	119(27.6)	59(50.0)	60(50.0)		
Share room with many people				0.20	0.651
No, with just 2 others	302(70.0)	131(43.4)	171(56.6)		
Yes, with 2+ people	129(30.0)	59(45.7)	70(54.3)		
ITN thorn beyond repairs				3.87	0.049*
No	367(85.1)	169(46.0)	198(54.0)		
Yes	64(14.9)	21(33.0)	43(67.0)		
Difficult/stressful hanging ITN				0.84	0.36
No, not difficult	298(69.1)	127(42.6)	171(57.4)		
Yes, is difficult	133(30.9)	63(47.4)	70(52.6)		
Perception of low mosquitoes population density in the locality				31.55	<0.0001*
Mosquitoes exist	330(76.6)	170(51.5)	160(48.5)		
No mosquitoes	101(23.4)	20(19.8)	81(80.2)		
Use mosquito spray, coil & repellent				0.68	0.411
No	272(63.1)	124(45.6)	148(54.4)		

Yes	159(36.9)	66(41.5)	93(58.5)		
Difficulty breathing under ITN				1.10	0.295
No, breaths normally	352(81.7)	151(42.9)	201(57.1)		
Yes, difficult breathing	79(18.3)	39(49.4)	40(50.6)		

*=p<0.05

4.10 Demographic characteristics of respondents associated with ITN utilization among pregnant women in the Wa East district.

One-third of the respondents 33.0% (142/431) were aged 30-39 years and they were more likely to use their ITNs compared to respondents that were <20 years as they were 2.8 times more likely to sleep under their ITNs compared to those <20 years. Also, pregnant women aged 40-49 years have 2.7 times the odds of sleeping under an ITN compared to those below 20 years. Respondents that had Quranic education were more likely to use an ITN compared with respondents with neither formal nor Quranic education. With reference to occupation, students and seamstresses were seen to have 2.2 and 2.05 times the odds of sleeping under an ITN respectively compared to those that were unemployed (house wives). Also, respondents with three (3) children were less likely to use ITNs compared with those with no child.

Table 11: Demographic characteristics of pregnant women associated with ITN utilization in Wa East district, January 2018.

Variable	ITN Users N=190(%)	ITN Non-Users N=241(%)	Crude Odds Ratio (cOR)	95% Confidence Interval (CI)	P-value
Age of Respondent (Years)					
<20	9(26.5)	25(73.5)	1.0		
20 – 29	89(42.0)	123(58.0)	2.0	0.89-4.51	0.091
30 – 39	71(50.0)	71(50.0)	2.8	1.21-6.37	0.016*
40 -49	21(48.8)	22(51.2)	2.7	1.01-6.98	0.048*
Marital Status of Respondents					
Single	33(47.1)	37(52.9)	1.0		
Married	148(43.8)	190(56.2)	0.87	0.52-1.46	0.607
Cohabiting	2(33.3)	4(66.7)	0.56	0.09-3.26	0.520
Divorced	5(50.0)	5(50.0)	1.12	0.29-4.22	0.866
Widowed	2(28.6)	5(71.4)	0.45	0.08-2.46	0.357
Religious Affiliation					
Christian	69(43.7)	89(56.3)	1.0		
Islam	116(43.8)	149(56.2	1.0	0.67-1.49	0.984
Traditional African Religion (TAR)	5(62.5)	3(37.5)	2.15	0.49-9.31	0.306
Ethnicity					
Sissala	42(43.8)	54(56.2)	1.0		
Waala	81(38.6)	129(61.4)	0.8	0.49-1.32	0.392
Dagao	49(55.7)	39(44.3)	1.6	0.90-2.89	0.107
Chakalu	8(66.7)	4(33.3)	2.6	0.72-9.12	0.144
Akan	7(35.0)	13(65.0)	0.7	0.25-1.89	0.473
Others	3(60.0)	2(40.0)	1.9	0.31-12.07	0.483
Highest Educational Level					

	No Formal Education	78(44.1)	99(55.9)	1.0	
	Basic Level (BECE)	49(41.9)	68(58.1)	1.02	0.63-1.66	0.930
	Secondary Level (SSCE)	36(47.4)	40(52.6)	1.28	0.74-2.21	0.383
	Tertiary	27(44.3)	34(55.7)	1.13	0.62-2.04	0.695
Occupation of Respondents						
	Unemployed (House wife)	35(33.7)	69(66.3)	1.0	
	Farming	61(44.5)	76(55.5)	1.58	0.93 - 2.68	0.089
	Seamstress	24(51.1)	23(48.9)	2.05	1.02 - 4.15	0.044*
	Business (Buying & Selling)	16(53.3)	14(46.7)	2.25	0.99 – 5.14	0.054
	Government Employed	25(43.1)	33(56.9)	1.49	0.77 – 2.89	0.234
	Student	29(52.7)	26(47.3)	2.2	1.13 – 4.29	0.021*
Parity						
	0	48(52.8)	43(47.2)	1.0	
	1	36(41.9)	50(58.1)	0.65	0.36 – 1.17	0.148
	2	37(44.6)	46(55.4)	0.72	0.39 – 1.31	0.282
	3	28(36.4)	49(63.3)	0.51	0.28 – 0.95	0.034*
	4	21(46.7)	24(53.3)	0.78	0.38 – 1.60	0.505
	≥5	20(40.8)	29(59.2)	0.62	0.31 – 1.25	0.179

*$p<0.05$

4.11 Other factors associated with ITN utilization among pregnant women in the Wa East district, January 2018.

Respondents living in rural areas were 1.84 times more likely to sleep under an ITN compared to those in town areas. Place of residence is therefore statistically significantly associated with sleeping under an ITN [cOR: 1.84; (95% CI: 1.22-2.77)]. Respondents who have ever heard of ITNs were 3.4 times more likely to sleep under an ITN relative to those who have never heard of ITN and this is statistically significant. Ownership of ITN was also statistically significantly associated with sleeping under ITN [cOR: 4.49; (95% CI: 2.33-8.66)]. This means respondents that owned ITNs were 4.49 times more likely to sleep under an ITN compared with their counterparts who do not own ITNs. The season of the year was found to be statistically significantly associated with ITN utilization. During the rainy season, respondents were found to have 7.45 times the odds of sleeping under an ITN compared to those who don't use ITNs in any of the seasons [cOR: 7.45; (95% CI: 50.97–57.29)]. Thus respondents who reported they mostly use ITNs during the rainy season were 7.45 times more likely to sleep under an ITN compared to those who do not use ITN at all. Also, respondents that use ITNs across all seasons have 159.37 times the odds of sleeping under an ITN compared to those who never use ITNs in any of the seasons [cOR: 59.37; (95% CI: 18.56-20.30)]. There is no much difference between those who owned 1, 2, 3, 4 and above 5 ITNs in relation to ITN utilization. Hence the number of ITNs owned is not statistically associated with ITN utilization.

Table 12: Factors influencing ITN utilization among pregnant women in the Wa East district, January 2018.

Variable	ITN Utilization		Crude Odds Ratio (cOR)	95% Confidence Interval (CI)	p-value
	ITN Users n=190 (%)	ITN Non-Users n=241(%)			
Place of residence					
Town	293(68.0)	178((60.7)	1.0		
Rural	138(32.0)	63(45.7)	1.84	1.22 – 2.77	0.003*
Share room with others					
Sleeps alone	18(40.0)	27(60.0)	1.0		
Sleeps with 1 person	41(41.4)	58(58.6)	1.06	0.52 – 2.17	0.871
Sleeps with 2 persons	50(45.1)	61(54.9)	1.23	0.61 – 2.49	0.565
Sleeps with 3 persons	21(30.9)	47(69.1)	0.67	0.30 – 1.47	0.319
Sleeps with 4 persons	33(54.1)	28(45.9)	1.77	0,81 – 3.86	0.153
Sleeps with 5+ persons	27(57.5)	20(42.5)	2.03	0.88 – 4.65	0.096
Heard of ITN					
No	0(0.00)	11(100.0)	1.0		
Yes	190(45.2)	230(54.8)	3.4	3.50-6-70	0.035*
Ownership of ITN					
No	12(17.7)	56(82.3)	1.0		
Yes	178(49.0)	185(51.0)	4.49	2.33 – 8.66	<0.0001*
Number of ITNs owned					
1 ITN	67(47.9)	73(52.1)	1.0		
2 ITNs	66(44.0)	84(56.0)	0.86	0.54 – 1.36	0.510
3 ITNs	26(54.1)	22(45.9)	1.29	0.67 – 2.49	0.451
4 ITNs	13(72.2)	5(27.8)	2.83	0.96 – 8.37	0.060
≥5 ITNs	6(85.7)	1(14.3)	6.54	0.77–55.72	0.086

Sleeping under ITN can protect against malaria infection

No, it does not protect	179(46.0)	214(54.0)	2.05	0.99 – 4.25	0.053
Yes, it protects	11(29.0)	27(71.0)	1.0		
Season of year most likely to use ITN					
None	1(6.0)	15(93.8)	1.0		
During the rainy season	102(33.2)	205(66.8)	7.46	50.97–57.29	0.050*
During the dry season	2(13.2)	13(86.7)	2.31	0.19–28.47	0.514
All year round	85(91.4)	8(8.6)	59.37	18.56-20.30	<0.0001*

*p<0.05

Respondents that admitted that there were low mosquito population densities in their localities/rooms were 0.23 times less likely to sleep under an ITN compared to those who indicated mosquitoes exist in their localities. Therefore the density of mosquitoes was statistically significantly associated with ITN utilization [cOR: 0.23; (95% CI: 0.14-0.39)] as detailed in Table 13.

Table 13: Other factors influencing ITN utilization among pregnant women in the Wa East district, January 2018.

Variable	ITN Users n=190 (%)	ITN Non-Users n=241(%)	Crude Odds Ratio (cOR)	95% Confidence Interval (CI)	p-value
Chemical on ITN itches skin					
No, doesn't itch skin	73(41.3)	105(59.0)	1.0		
Yes, it itches skin	117(46.3)	136(53.7)	1.24	0.84–1.82	0.281
Discomfort (heat, warmth, sweats) sleeping under ITN					
No discomfort	83(44.0)	106(56.0)	1.0		
Yes, is discomfortable	107(442)	135(55.8)	1.01	0.69–1.48	0.950
Inadequate / small sleeping space					
No, had adequate room size	131(42.0)	181(58.0)	1.0		
Yes, room too small	59(50.0)	60(50.0)	1.36	0.89-2.08	0.156
Share room with many people					
No, with just 2 others	131(43.4)	171(56.6)	1.0		
Yes, with 2+ people	59(45.7)	70(54.3)	1.10	0.73–1.67	0.652
ITN thorn beyond repairs					
No	169(46.0)	198(54.0)	1.0		
Yes	21(33.0)	43(67.0)	0.57	0.33-1.0	0.051
Difficult / stressful hanging ITN					
No, not difficult	127(42.6)	171(57.4)	1.0		
Yes, is difficult	63(47.4)	70(52.6)	1.21	0.80-1.83	0.359
Perception of low mosquitoes population density in locality					
Mosquitoes exist	170(51.5)	160(48.5)	1.0		
No mosquitoes	20(19.8)	81(80.2)	0.23	0.14-0.39	<0.0001*
Use mosquito spray, coil & repellent					
No	124(45.6)	148(54.4)	1.0		

Yes	66(41.5)	93(58.5)	0.85	0.57–1.26	0.411
Difficulty breathing under ITN					
No, breaths normally	151(42.9)	201(57.1)	1.0		
Yes, difficult breathing	39(49.4)	40(550.6)	1.29	0.79–2.12	0.296

4.12: Simple and multiple logistic regression of factors influencing ITN utilization among pregnant women in the Wa East district, January 2018.

Table 14 summarized the associated factors of ITN utilization among pregnant women in the Wa East district using binary and multiple logistic regression models. The outcome revealed that the odds of sleeping under an ITN for ages 40-49 years is increased 2.7 fold compared to mothers aged below 20 years [OR: 2.7; (95% CI: 1.01-6.98)]. The odds of sleeping under an ITN for ages 30-39 years is also increased 2.8 fold compared to mothers aged below 20 years [OR: 2.8; (95% CI: 1.21-6.37)]. On respondents occupation, mothers that were seamstresses had an increased odds of 2.05 whilst students had an increased odds of 2.2 sleeping under an ITN compared to mothers that are unemployed (house wives) [OR: 2.05; (95% CI: 1.02-4.15)] and [OR: 2.2; (95% CI: 1.13-4.29)] respectively. Para 3 mothers had 49% reduced odds of sleeping under an ITN compared to para 0 (zero) mothers [OR: 0.51; (95% CI: 0.28-0.95)]. The odds of sleeping under an ITN is increased 1.84 fold among rural dwellers compared to town dwellers [OR: 1.84; (95% CI: 1.22-2.77)]. On presence of mosquitoes in locality, respondents with the believe that there is no or fewer mosquitoes population density in their locality had 77% reduced odds of sleeping under an ITN compared to respondents with the believe that there are higher mosquito population densities in their localities [OR: 0.23; (95% CI: **0.136-0.397**)].

The multiple logistic regression found age, parity, place of residence, number of ITN owned, the season of the year and the presence of mosquitoes (mosquitos' population density) as associated with sleeping under an ITN after adjusting for other confounders. These factors were found to be

significantly associated with ITN utilization after adjusting for all the independent variables that initially appeared to be statistically significantly associated with ITN utilization. This, therefore, comes to confirm that the factors that predict ITN utilization in Wa East district among pregnant women were: age, parity, place of residence, number of ITNs owned, the season of the year, and the perception of mosquitos' population density in respondents' locality.

Table 14: Logistic regression of factors associated with ITN Utilization among pregnant women in the Wa East district, January 2018.

	Unadjusted		Adjusted	
Characteristic	cOR	95% CI	aOR	95% CI
Age of Respondents (Years)				
<20	1.0			
20-29	2.0	(0.89-4.51)	4.27	**(1.037-17.552)***
30-39	2.8	**(1.21-6.37)***	12.35	**(2.476-16.625)***
40-49	2.7	**(1.01-6.98)***	16.09	**(2.563-11.083)***
Highest Educational level				
No formal education	1.0			
Basic Level (BECE)	1.02	(0.63-1.66)	0.70	(0.293-1.69)
Secondary Level (SSCE)	1.28	(0.74-2.21)	0.35	(0.118-1.054)
Tertiary	1.13	(0.62-2.04)	0.75	(0.085-6.571)
Occupation of Respondents				
Unemployed (House wife)	Ref			
Farming	1.58	(0.93-2.68)	0.75	(0.289-1.772)
Seamstress / Hairdresser	2.05	**(1.02-4.15)***	1.56	(0.479-5.106)
Business (Buying & Selling)	2.25	(0.99-5.14)	2.26	(0.591-8.049)
Government Employed	1.49	(0.77-2.89)	0.13	(0.15-1.178)
Student	2.2	**(1.13-4.29)***	0.63	(0.142-2.774)
Parity				
0	1.0			
1	0.65	(0.36-1.17)	0.31	**(0.101-0.967)***
2	0.72	(0.39-1.31)	0.11	**(0.025-0.452)***
3	0.51	**(0.28-0.95)***	0.07	**(0.016-0.321)***
4	0.78	(0.38-1.60)	0.09	**(0.018-0.421)***
≥5	0.62	(0.31-1.25)	0.02	**(0.042-0.136)***
Ethnicity				
Sissala	1.0			
Waala	0.8	(0.49-1.32)	0.38	**(0.164-0.881)***
Dagao	1.6	(0.90-2.89)	0.62	(0.222-1.737)
Chakalu	2.6	(0.72-9.12)	0.78	(0.117-5.235)
Akan	0.7	(0.25-1.89)	0.47	(0.068-3.281)
Place of residence				
Town	1.0			
Rural	1.84	**(1.22-2.77)***	2.03	**(1.026-4.026)***

Number of ITNs owned				
1 ITN	1.0		1.0	
2 ITNs	0.86	(0.54-1.36)	1.72	0.749-3.950)
3 ITNs	1.29	(0.67-2.49)	3.26	**1.136-9.345)***
4 ITNs	2.83	(0.96-8.37)	1.94	(0.348-10.79)
≥5 ITNs	6.54	(0.77-55.72)	11.35	(0.680-19.271)
ITNs protects against malaria				
Yes	1.0			
No	2.05	(0.99-4.26)	0.97	(0.254-3.682)
Presence of mosquitoes in locality				
No mosquitoes	0.23	**(0.136-0.397)***	0.21	**(0.092-0.474)***
Mosquitoes exist	1.0			
ITN thorn				
No	1.0			
Yes	0.57	(0.327-1.00)	0.63	(0.243-1.611)
Season of year most likely to use ITN				
Never	1.0			
During the rainy season	7.46	(0.972-5.291)	0.16	**(0.005-0.502)***
During the dry season	2.31	(0.187-28.47)	0.002	**(0.001-0.021)***
All year round	15.9	(18.56-36.34)	0.001	(0.075-1.98)

CHAPTER FIVE

DISCUSSIONS

The study assessed the factors influencing the utilization of ITNs among pregnant women in Wa East district, Upper West region.

Majority of the respondents were in the age range of 20-29 years constituting 49.1% (212/431) with about 42% (89/212) of them using ITNs while 50% (71/142) of those that were between 30-39 years used ITNs. Though chi-square test shows that age was not significantly associated with ITN utilization, simple logistic regression shows significant association within age strata 30-39 [p:0.016] and 40-49 [p:0.048] and ITN utilization (Table 12). This means being 30-49 years was therefore found to be associated with a higher odd of sleeping under an ITN. This is in keeping with a similar study by (Atieli et al., 2011) where they noted significant differences in ITN utilization among different age groups in a study on ITN ownership and use among households in the highland areas of western Kenya. Controlling for other factors, age proved to be statistically significantly associated with ITN utilization [aOR: 16.09; (95% CI: 2.56-11.08)] (Table 14).

There was no statistically significant difference observed in the marital status of respondents and ITN utilization, this contrasts with a related study by Kimbi et al. (2014), where married pregnant women were 6.6 times more likely to sleep under ITN compared with single pregnant women with a p-value of 0.014, at [95% CI: 1.46–30.64] likewise the findings of Ernest et al. (2017).

Though majority of the respondents 61.4% (265/431) were muslims, there was no statistically significant difference in ITN utilization across the religious groups. Just 1.9% (8/431) of them were adherents of the traditional African religion. Chi-square test suggests a significant association between ethnicity and ITN utilization. However, on simple logistic regression, there is no significant difference in ITN use across the various ethnic groups. In this study, respondents that

had Quranic education have nearly four times higher odds of ITN use relative to their counterparts who had no formal education at all [cOR: 3.89; [95% CI: 1.19-12.77]. This relates to the practice of routine monthly pregnancy classes offered by CHOs in the muslim communities. This study also revealed that respondents with higher education were also 1.13 times (13%) more likely to sleep under an ITN compared with their counterparts that had no formal education at all [cOR: 1.13; (95% CI: 0.62-2.04)], though this is not statistically significant. Kimbi et al., (2014) noted in their study that educational level and knowledge about malaria transmission were some of the significant contributors influencing ownership and usage of ITN. People with higher education and knowledge were found to be more likely to use ITN compared with their counterparts with no or lower formal levels of education. Baume & Franca-Koh, (2011) found in their study that pregnant women of higher educational level were also significantly more likely to use ITN compared to those with no / less formal education with an [OR: 2.32; (95% CI: 1.58-3.40)].

This study revealed that being a seamstress, one is 105% more likely whereas students were 120% more likely to use an ITN relative to being unemployed (housewife). And these are statistically significant [cOR: 2.05; (95% CI: 1.04-4.15)], and [cOR: 2.2; (95% CI: 1.13-4.29)]. Also, being a business pregnant woman or a government employee has 2.25 and 1.49 higher odds of sleeping under an ITN relative to those unemployed, though these are not statistically significant as detailed in Table 12. These groups of respondents are more conscious about their health and would not want to part with hard earned money to treat malaria and as such will use their ITNs to prevent malaria infection. This finding contrast that of the GDHS (2014) results, where women of low socio-economic status (SES) were about two times more likely to have slept under an ITN (68.3%) compared with pregnant women of higher socio-economic status (SES) (37.2%).

The simple logistic regression revealed that pregnant women with three (3) children were 0.51 times less likely to use an ITN compared with pregnant women with no child and this is statistically significant. Also, having just a child in the study makes you less likely to use an ITN by 35% whereas those respondents with two (2) children were less likely to use an ITN by 28% relative to those not having any child, though these are not statistically significant.

In this study, majority of the respondents, 68% (293/431) were in town / urban settings, and one's place of residence was found to be significantly associated with ITN utilization (Table 4.9 & 4.12). Pregnant women in this study who live in rural areas (hinterlands) were more likely to use ITNs by 84% compared to those in town settings and is shown to be statistically significant [cOR: 1.84; (95% CI: 1.22-2.77)]. People in rural areas (hinterlands) usually have no or lower formal education, and easily adhere to and practice health interventions they are thought by CHOs compared to their urban counterparts who are too busy with economic activities to listen to health messages. This finding supports that of Baume & Franca-Koh, (2011) where pregnant women in rural locations were more likely to use ITNs than those in town/urban settings with a [cOR: 1.92 (95% C.I: 1.49-2.47)]. This, however, contrasts with Kimbi et al., (2014) where they indicated there was a statistically significant difference observed, where pregnant women in urban communities were 5.99 times more likely to sleep under ITN than those in rural communities with [p=0.041; (95% CI: 1.078–33.29)].

Chi-square test in this current study revealed that the number of persons a respondent shares room with was associated with ITN utilization but this diminishes when logistic regression was conducted indicating there is no significant difference in the number of people one share room with and ITN utilization (Table 13). Those who have heard ITN messages before were 3.4 times more likely to sleep under an ITN relative to their counterpart who have never heard of ITN, and

this is statistically significant [cOR: 3.4; (95% CI: 3.50-6.70)]. The numerous health education sessions held at ANCs, OPDs, durbar grounds, and radio messages on malaria reduction interventions might have resulted in almost every respondent 97.5% (420/431) having heard of ITN before in this study. Midwives and CHOs at ANC sites are encouraged to sustain this gain, educating pregnant women at points of ITN distribution to improve on ITN usage in the district. Though universal coverage (100% ownership) are the new targets towards the control of malaria following the Abuja declaration, there still exist questions to be answered despite the numerous interventions to meet this(Menéndez et al., 2015) and (Roman et al., 2015).

This current study revealed that ITN ownership among pregnant women in the Wa East district stands at 84.2% (363/431) with only 44 % (190/431) ITN utilization among this group. With the current policy of continues LLIN / ITN distribution intervention, one would have expected to see 100% ITN possession by all registered pregnant women across the district with the background knowledge that there hasn't been any shortage of ITNs in health facilities following the universal coverage campaign in the district. Could it be that midwives register pregnant women in the district but don't give them the mandatory point of registration ITNs? This again is in keeping with the findings of Ernest et al., (2017) in a related study that found that, though ITN ownership among pregnant women in the Ashanti region of Ghana – Kumasi, was 78% only 47% used their ITNs the night before the survey. The Ghana malaria indicator survey by Ghana Statistical Service (GSS), Ghana Health Service (GHS), ICF, (2017) estimated 67.1% and 60.8% utilization of ITNs among pregnant women and children under five respectively with 89.7% ownership of ITNs. A coverage of 39.5% ITN utilization among children under five children and 41.3% ITN utilization coverage among pregnant women was noted by Hetzel et al., (2012) in Papua New Guinea.

Similarly, a study in the Anambra state in Nigeria, authored by Ukibe, Ikeako, Mbanugo, Obi-Okaro, & Ukibe, (2014) found that 94% of the participants were well aware of ITN with 60% owning at least an ITN with just 46% actually sleeping under ITNs. The GDHS by Ghana Statistical Service (2014) indicated 47% utilization of ITN among pregnant women which is not much different from this current study. The slight variations might be due to differences in sampling and sample sizes. Respondents who own more than five ITNs were more likely to sleep under an ITN though this isn't statistically significant [cOR: 6.54; (95% CI: 0.77-55.72)]. There is no statistically significant difference observed in the number of ITN owned and ITN utilization, though an association appears to exist between the number of ITNs owned and sleeping under an ITN. People who own more ITNs are tempted to store them sealed.

The logistic regression results in Table 13 revealed that, though majority of the respondents constituting 91.2% (393/431), reported that, sleeping under an ITN does not protect against malaria infection, yet they were 2.05 times more likely to sleep under an ITN though not statistically significant [cOR: 2.05; (95% CI: 0.99-4.25)]. This means some respondents sleep under ITNs not primarily to protect themselves from malaria infection but for other reasons.

In this current study, seasonal variation was statistically significantly associated with ITN utilization. Majority of the respondents 71.2% (307/431) were 7.46 times more likely to use ITNs during the rainy season relative to those who don't sleep under ITN in any of the seasons [cOR: 7.46; (95% CI: 50.97-57.29)]. For the dry season preference group (3.5%) (15/431), they were 2.31 times more likely to use an ITN compared to those who reported not to have ever slept under an ITN, though this is not statistically significant as detailed in Table 13. For respondents who reported they are most likely to use ITNs all-year-round 21.5% (93/431), were 59.37 times more likely to sleep under an ITN relative to their counterparts who prefer not using ITN. And this was

statistically significant [95% CI: 18.56-20.30]. The existence of mosquitoes is at peak during the rainy season because of abundant water bodies for mosquito breeding and this could have informed respondents' preference. A similar study in Cameroon by Kimbi et al., (2014) showed similar results with seasonal variation greatly influencing ITN use by pregnant women, where about four folds increase in ITN use was recorded (13.8%) in the rainy season compared to the dry season (3.4%). The findings of Atieli et al., (2011) in Kenya also found slightly related results where ITN usage during the dry season was significantly lower (49.5%) than that in the rainy cool season (61.8%) with an [OR: 0.6; χ^2:37.8; $p<0.0001$]. A classic study by Binka & Adongo, (1997) in the northern belt of Ghana on the acceptability and use of insecticide-impregnated bed nets (IIBNs) revealed that, the use of bed nets was predominantly seasonal with almost all recipients (99%) using their IIBNs in the rainy season which denotes and is the peak of the period of high mosquito density and just 20% of the respondents using them in the dry seasons, the period of low mosquito density. A related study by Pell, Straus, Andrew, Meñaca, & Pool, (2011) also found that the uptake of ITNs as an intervention in malaria control basically depends on the season - rainy or dry season. Again, this study revealed that the under listed personal factors encompassing body itch due to chemicals on ITN, discomfort (heat, warmth and sweat), inadequate or small sleeping space, thorn ITN, difficulty or stress in hanging ITN, use of mosquito spray, insecticide coil, mosquito repellent, and difficulty breathing under ITN were all not statistically significantly associated with ITN utilization in this study. This may be as a result of the intense public sensitization carried out in 2012 during the mass LLINs hang-up campaign that has demystified and changed respondents' personal attitudes and perceptions about these factors for good. As in Table 14, respondents who find it difficult breathing under ITN were 1.29 times (29%) more likely to sleep under an ITN relative to those who breaths normally sleeping under an ITN though not significant. Also,

respondents who use mosquito spray, coils and repellents were also 0.85 times (15%) less likely to sleep under an ITN but this was also not statistically significant. This is because they think they are protected from mosquito bite using these alternative interventions. In addition, respondents that perceive hanging ITN for use to be difficult were also 1.21 times (21%) more likely to use an ITN compared to their counterparts who reported it was neither difficult nor stressful hanging an ITN but this again was also not significant. The chemical on ITNs itching respondents' skin as reported by 58.7% (253/431), a higher percentage 46.3% (117/253) despite that still used their ITNs in this study. Thus, they were 1.24 times more likely to use ITNs compared with respondents whose skin do not react to the ITN chemicals [cOR: 1.24; (95% CI: 0.84-1.82)]. This results contrast with the study findings of Manu et al., (2017) in the central belt of Ghana around Kintampo among pregnant women found that, more than 90% of respondents found ITNs to be uncomfortable to use during pregnancy, with regard to the perception that they entrap heat especially during warm weather or dry seasons whilst 15% of them can not at all sleep under an ITN without fun. The chemical used to treat the nets was described to have an unpleasant smell that resulted in about 15% of pregnant women vomiting or experiencing difficulty in breathing making them not to sleep under ITNs. Below is a verbatim report from a respondent in a FGD supporting this point.

> *"Because of the medicinal scent in the net, some pregnant women do not want to sleep in it, because it will make them vomit though sleeping in an ITN will prevent you from getting malaria. (R6: FGD, D/Nkwanta)*
>
> *There is always heat in the ITNs so during pregnancy it becomes uncomfortable to sleep in. You would, therefore, wish to pour water on the ground to sleep on. That is why we cannot sleep in an ITN. (R5: FGD, Akumsa* Domase)"

The author again noted that 51.7% of the respondents outlined some alternative malaria prevention strategies they use including: the use of mosquito coil, mosquito spray, indoor residual spray, and

repellants or burning other substances to drive mosquitoes away to prevent their bites that make them not to use ITNs as reported by one of them in an in-depth interview conducted in Kakuma.

> *"You can buy mosquito coil and light it in your room to prevent the mosquitoes. You can also burn the palm kennel to prevent mosquitoes in our homes.* (IDI, Kokuma)"

Similar work by Ukibe et al., (2014) in the Anambra state in Nigeria revealed that factors like heat (40%), inadequate accommodation/room space to hang net (13.3%), net causing itching (0.7%) and just don't like nets (0.4%) were mentioned by the respondents as the reasons why they are not sleeping under ITNs.

However, the perception of low mosquitoes population density in respondents' localities or rooms was statistically significantly associated with ITN utilization [cOR: 0.23; (95% CI: 0.14-0.39)]. This means that respondents that reported there were low mosquitoes' population densities in their localities or rooms were 77% less likely to sleep under an ITN. They see no need to sleep under ITNs when there are no mosquitoes in their localities, forgetting that, mosquitoes are almost at every place in their endemic zones though their densities may vary partly due to seasonal variations and IRS intervention.

Even though age, educational level, occupation, parity, ethnicity, place of residence, number of ITNs owned, believe ITN protects against malaria infection, season of year, existence of mosquitoes in their localities or rooms, and status of ITN - (thorn ITN) were all initially significantly associated with ITN utilization following Chi-square tests and simple logistic regression, only age, parity, place of residence , number of ITNs owned, the existence of mosquitoes in the locality, and seasonal variations sustained their statistically significant associations with ITN utilization after controlling or adjusting for other variables in a stepwise fashion. Also, though some factors like occupation, educational level, chemicals used in treating ITN (skin itching) and discomfort were revealed by literature to have a statistically significant

relationship with ITN utilization, multiple logistic regression found no statistically significant association between them and sleeping under ITN.

5.1 Limitations of the study

1. The response from respondents could be subjected to recall and information bias just to provide ideal expected information.
2. The study also excluded all pregnant women who did not attend ANC in the sampled health facilities since the study was health facility based. So the results may not be applicable to the general population.

CHAPTER SIX

CONCLUSIONS AND RECOMMENDATIONS

6.1 Conclusions

The findings in the study were not much different from what was found in the literature, however, few results were the opposite of what is found in other studies. The results show low ITN utilization coverage (44%) among the sample of respondents.

It revealed that age, parity, place of residence, number of ITNs owned, seasonal variations, and the perception of mosquitoes population density in respondents' locality were the main factors found to be statistically and significantly associated with or influencing and predicting the utilization of ITNs among pregnant women in Wa East district, after adjusting for other confounders. ITN use in the Wa East district by pregnant women is also influenced and vary by seasons and higher in the rainy season.

6.2 Recommendations

Based on the findings of this study, the following recommendations are made:

1. The DHA through the malaria coordinator and the public health nurse should strengthen monitoring visits to ANC sites to ensure that all pregnant women registered are actually given ITNs by the midwives to improve on the current 84.2% ITN ownership coverage.
2. Community Health Officers (CHOs) to target town dwellers and multiparous women intensifying home visits and education on ITN consistent use, to bridge the gap between ownership (84.2%) and utilization.
3. The health education and promotion (HEP) unit of the district to roll out rigorous interventions to change behavior by strengthening community based communication

strategies like; Behavior Change Communication (BCC), Inter-personal Communication (IPC), and Communication for Development (C4D) interventions to address barriers to ITN utilization bridging the gap between ITN possession and use

4. The DHA with support from the NMCP to step-up year-round public sensitizations on ITN consistent use through varied media not only during the rainy seasons.

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APENDICES

Appendix 1: Information Sheet and Consent form

Dear Participant,

You have been selected to participate in this survey titled **"**Factors Influencing the Utilization of ITN by Pregnant Women in Wa East District of Upper West region". This study is been conducted by Mr. Asani Dinkpee, the Principal Investigator**,** and a student of the University of Ghana, School of Public Health, College of Health Science, Department of Epidemiology and Disease Control, P. O. Box LG 73, Legon, in partial fulfillment for the award of a Masters of Public Health (MPH) degree**. Contact:** Mobile 0209061562 / 0541093877; **Email**: hassand28@gmail.com / dasani@st.ug.edu.gh

General information about the study

This is a research study being undertaken as a requirement in the University of Ghana, School of Public Health, Legon, to attain a master's degree in public health. This is useful in planning health education programs that could be implemented during antenatal sessions and public sensitization at both local and national levels which will help reduce malaria in pregnancy, maternal morbidity and mortality as well as some adverse effects of malaria among pregnant women encompassing preterm deliveries, maternal anemia and congenital malaria because of malaria in pregnancy and worst of all, maternal deaths.

Procedures

Pregnant women from the catchments of four (4) randomized sub-districts' health centers will be used in this study. Eligible participates who will agree and voluntarily consent to participate in this study, will be required to complete a structured questionnaire. We will ask questions about your demographic background, questions on whether or not you own a mosquito bed net and whether

you slept under a mosquito bed net last night. Questions on some personal and individual factor that influence you (pregnant woman) to sleep under mosquito bed nets as well as how seasonal variations influence or inform you (pregnant woman) to use or sleep under mosquito bed nets.

Possible Risks and Discomforts

This study or interactive process with you in the next thirty minutes if you agree to take part will not have any risk or harmful consequences to you as a person, or to your image or self-esteem. However, the only inconvenience may be the fact that you will spend your precious time, maximum thirty minutes with us to complete this survey.

Possible Benefits

There is no direct tangible benefit to the participants of this study. However, participants will learn a great deal of healthy, preventive and promotive life practices and a free consultation, especially on malaria prevention. It is important to note that your participation in this study will enable you to learn about ITN use as a cost-effective measure in prevention malaria as well as other key malaria preventive measures. The overall findings of the study too will add to knowledge and inform stakeholders, partners who matter in formulating, modernizing and planning useful health educational program that could be rolled out during antenatal sessions and other public sensitizations fora at both local and national levels which will help reduce malaria in pregnancy and its adverse consequences in particular and other maternal morbidities.

Confidentiality

The information you provide will be treated totally and strictly confidential and will not be disclosed to anyone except for an academic purpose. No response you give will be specifically identified or linked with you but will be combined with the general responses of the entire population. We assure you that your name shall not appear or be mentioned in any report that might come out from this study. Administration of the questionnaire will be done in an isolated empty room

within the facility premise.

Voluntary Participation and Right to Refuse

Your participation in this study is purely voluntary and you are liberty to withdraw in the course of the interview. During the filling of the questionnaire, you can choose to ignore any questions that you are uncomfortable with. However, we will encourage you to participate and complete the questions since your opinion and contribution are highly valuable to us to be able to make informed decisions that will benefit us all and generations yet unborn.

Your rights as a Participant

Approval for this study has been given by the Ghana Health Service Ethics Review Committee (GHS-ERC) which is in-charge of approving studies that are to be conducted within the jurisdiction of the Ghana health services on health among human subjects or population are free from harm. If you so desire to find out or cross check with the ethics review committee/board (GHS-ERC) on this study or ask any questions about your rights as a research participant, you may please at your convenience contact the Administrator of the GHS Ethical Review Committee at the following address:

Hannah Frimpong, GHS-ERC Administrator, Office: +233 302 681109, Mobile: **233 (0) 243235225 or 0507041223,** Email: Hannah.Frimpong@ghsmail.org

Or

Nana Abena Kwaa, Assistant Administrator GHS-ERC, Mobile: 0244712919, Email: nanatuesdaykad@yahoo.com

If you have any questions later, you may contact:

1. **Principal Investigator:** Mr. Asani Dinkpee,

University of Ghana, School of Public Health, Department of Epidemiology and Disease Control, P. O. Box LG 73, Legon. Contact: Mobile 0209061562 / 0541093877; **Email**: hassand28@gmail.com / dasani@st.ug.edu.gh

Or

2. **The academic Supervisor: PROF. COL. EDWIN A. AFARI (RTD).,**

University of Ghana, School of Public Health, Department of Epidemiology and Disease Control, P. O. Box LG 73, Legon**. Contact:** Mobile: +233 (0)208131828 / **Email**: afariea@yahoo.co.uk

Signing or thumb printing this consent form indicates your understanding of what will be expected of you and your readiness to participate in the study.

Thank you.

Appendix 2: Participant's Voluntary Informed Consent form

I hereby provide INFORMED CONSENT to participate in this study titled **"**Factors Influencing the Utilization of Insecticide Treated bed Nets (ITNs) by Pregnant Women in the Wa East District of Upper West Region" without been coerced by the interviewer.

I ……., therefore declare that, the above document describing the purpose, procedures as well as risks and benefits of the research titled **"**Factors Influencing the Utilization of ITN by Pregnant Women in Wa East District of Upper West Region", has been thoroughly explained to me in English language / Waali,/ Dagaari,/ Sissaali,/ Chakali or Twi or I have read the foregoing information, where I asked questions about the research which were appropriately answered to my satisfaction. . I therefore with no reservation, hereby voluntarily consent to participate as a subject in this all-important study and understand that I have the right to withdraw from the study at any time without in any way it affecting my further medical care.

Signature of Participant ……. Or Thump print……..

Date_____/_____/_____ Time: ……..

Witness of Participant: ……..…..……

Signature ……..Thump Print: ……. Date: …….. Time: …..

Appendix 3: Researcher's / Interviewer's statement

I, _____, certify that the nature and purpose, the potential benefits and possible risks associated with participating in the study have been explained to the above individual in the English language, Waali,/ Dagaari,/ Sissaali,/ Chakali or Twi where the participant seem to have perfectly understood the content and what is expected of her and has freely agreed to participate in the study on this _____ day of _____/ 2018.

Signature _____ of person who obtained consent.

Appendix 4: Questionnaire for respondents

Dear Respondent, I am a student of the University of Ghana, School of Public Health, conducting a research on factors influencing the utilization of ITNs among pregnant women in the Wa East district of Upper West Region. I am pleased to have you in this study as your opinions and contributions to this study are highly valued. I entreat you to please, respond to the questions by giving honest and accurate answers as your responses will contribute to the success of this study by providing baseline information about the current prevalence of ITN use and find out the socio-demographic, personal or individual and seasonal factors that influence mosquito bed nets use among pregnant women in the Wa East district. This will help and provide baseline data for planning health educational programs – behavioral change communication (BCC) strategies that can be implemented during antenatal clinic (ANC) services for the general benefit of me, you and the whole community. You reserve the right to skip any question that you find uncomfortable answering. I hereby assure you that all the information that will be provided to these questions will be treated confidentially and anonymously. Thank you.

Data collector (s)…….

Form ID……

Data of collection …….

A. Socio-Demographic characteristics

No	Variable	Response	Code
1	Age	……	A1
2	Marital status	(0) Single (1) Married (2) Cohabiting (3) Divorced (4) Widow	A2
3	Religion	(0) Christianity (1) Islam (2) Traditionalist (3) Others	A3
4	Ethnicity	(0) Sissala (1) Waala (2) Dagao (3) Chakalu (4) Akan (5) Others	A4
5	Highest educational level	(0) Illiterate (1) Quranic literacy (2) Basic school (3) Secondary (4) Tertiary	A5
6	Occupational status	(0) Unemployed / housewife (1) Farming (2) Seamstress/hairdresser (3) Business (buying and selling) (4) Government employed (5) Student	A6
7	Parity	(0) 0 (1) 1 (2) 2 (3) 3 (4) 4 (5) 5 and above	A7

8	Place of residence	(0) Town (1) Rural	A8
9	Number of people respondent shares room with	(0) Sleeps alone (1) Share room with 1 other person (2) Share room with 2 other persons (3) Share room with 3 other persons (4) Share room with 4other persons (5) Share room with 5& above people	A9

B. Prevalence of ITN use among pregnant women

No	Variable	Response	Code
10	Have you heard of ITN before?	(0) No (1) Yes	B1
11	Do you own an INT?	(0) No (1) Yes If no, go to B4	B2
12	How many ITNs do you have/own?	(0) 1 (1) 2 (2) 3 (3) 4 (4) 5 and above	B3
13	Do you know that sleeping each night under ITN protects you from malaria infection?	(0) Strongly disagree (1) Disagree (2) Undecided (3) Agree (4) Strongly agree	B4
14	Did you sleep under an ITN last night?	(0) No (1) Yes	B5

C. Seasonal influence on utilization of ITN by pregnant women.

No.	Variable	Response	Code
15	Do you continuously sleep under an ITN every night throughout the year?	(0) No (1) Yes	C1
16	Which season of the year are you most likely to be sleeping under an ITN?	(0) (Will) never use an ITN - None (1) During the rainy season (2) During the dry season (3) All year round	C2

A. Individual or personal factors influencing the utilization of ITN by pregnant women.

What is your stand on the following reasons that sometimes make you not to sleep under an ITN?

NOTE,

Use this key to circle your stand for the reason as to why you sometimes do not use / never use an ITN

SD = Strongly Disagree, D = Disagree, A = Agree, SA = Strongly Agree

#No	Reason or factor for not using ITN	Your stand on the reason 0	1	2	3	Code
19	The Chemical on ITN itches my skin	SD	D	A	SA	D1
20	Sleeping under ITN causes discomfort- feel heat/warm/ sweat sleeping under ITN	SD	D	A	SA	D2
21	Inadequate room/sleeping space to hang ITN for use	SD	D	A	SA	D3
22	I share room with too many people	SD	D	A	SA	D4
23	My ITN is thorn beyond maintenance/sewing	SD	D	A	SA	D5
24	I don't own an ITN	SD	D	A	SA	D6
25	Difficulty or stress in hanging ITN in room	SD	D	A	SA	D7
26	There is low mosquitoes' population density in my room/locality	SD	D	A	SA	D8
27	I use mosquito spray, coils, repellent instead	SD	D	A	SA	D9
28	Difficulty breathing under ITN	SD	D	A	SA	D10

Thank you very much for your time, am grateful and enjoy having this session with you.

END OF QUESTIONNAIRE

Appendix 5: Detailed Budget

Category	**Item**	**Number / Quantity**	**Unit Cost**	**Frequency**	**Total Cost**
Stationary					
	Pens	10	1.5	1	15
	Pencils	10	1	1	10
	Erasers	5	1	1	5
	Files	5	6	1	30
	Bags	2	30	1	60
	Printing cost	5	30	4	600
Sub Total					**720**
Training of Research Assistant	Lunch & Snack	5	20	1	100
	T&T	4	30	1	120
Sub Total					**220**
Data Collection	Perdiem for RAs	4	40	8	1280
	T&T	5	15	8	600
Sub Total					**1880**
Communication	Credit for Communication	5	2	8	80
	Modem Data	1	20	10	200
Sub Total					**280**
Equipment	Computer	1	2100	1	2100
	Modem	1	50	1	50
	Flash memory	1	25	1	25
	External Drive	1	200	1	200
Sub Total					**2375**
Data Entry	Perdiem for Data Entry clerks	2	40	4	320
					320
Total Expenditure					**5795**
Miscellaneous (5%) of Total Expenditure =		**5,795**			**289.75**
GRAND TOTAL			**GHC**	**6,084.75**	

Budget Justification
Equipment

In this era of technological advancement where every activity is information communication and technology (ICT) based, there is the need to get in place some office equipment that will facilitate the execution and analysis of the research work, hence the need to purchase a laptop computer. Backing up the research report and data in a secondary storage system to safeguard the research report also called for the purchase of an external and a flash drive with which information could easily be picked on / transferred for printing. To facilitate electronic literature search online also called for the purchase of a modem.

Communication

To facilitate communication between the principal investigator and his academic supervisor as well as between the principal investigator and the research assistants during the period of data collection requires that credit for communication is made available to maintain interpersonal communications for clarifications if need be. Data for modem for online literature search will also be catered for under this section, hence this allocation.

Stationary

Stationary, encompassing pens, pencils, erasers, flat hard case files will be needed for the field work for recording purposes. There will be the need to get two medium-sized field bags with zips and locks in which field questionnaires will be temporarily stored for correction before data entry.

Training of Research Assistants

This is very important as the quality or validity and reliability of the research results and findings largely depend on the quality of the field data collected, and this also depends on how well the research assistants/data collectors are trained to be abreast with data collection skills in administering the questionnaires, hence the training of this data collectors. And as such a one-day

training and field practicum will be organized for the four (4) research assistants to build their skills in some five thematic pre-requisite areas of interest for this study.

They will be taken through the: General information sheet for the research, the Informed consent form and the need to get participants' consent before they take part in the study, some basic Interpersonal communication (IPC) skills, Questioning courtesies and finally, Field practical/pilot on the administration of the questionnaires in two different communities. This will call for their snack, lunch and travel and transport, hence this allocation.

Data collection

Data collection is planned to take eight days where the research assistant and the principal investigator will move to the data collection (ANC) sites on daily basis to administer the questionnaires to the participants and as such the need to facilitate their transportation to-and-from these sites as well as get the assistants some perdiem or field allowance to cater for their lunch and daily transport expenses**.**

Data entry

Next, after data have been collected from the field is to enter them into excel and SPSS employing the services of data entry clerks who will be directly under the supervision of the principal investigator. This will only be done after data quality checks have been done on every questionnaire by the principal investigator. Two days will be used to enter these and they will be paid allowance. This is necessary to ensure that the principal investigator have good data to analyze as the two set of data will be compared for consistency

Appendix 6: Schedule of Activities - Plan of Work

Gann Chart showing timeline of planned activities for the rollout of the study protocol														
No.	Activity	Time - Month												
		2017					2018							
		Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug
1	Assigned to Department													
2	Searching for a problem area to develop a Research Topic													
3	Streamlining and finalizing my topic													
4	Meeting with my academic supervisor to finalize the Research Topic													
5	Extensive literature review on the topic and meetings with NMCP staff on my intention to work on the chosen topic													
6	Gathering of resources and building my library for the study													

7	Writing up my Research Protocol covering chapter 1, 2 and 3												
8	Meeting supervisor with a progress report												
9	Departmental level presentation of chapter 1												
10	Developing Appendices - Informed consent form, Questionnaires, Budget												
11	Defending of Proposal												
12	Submission of proposal to GHS-ERC and Ethical Clearance												
13	Training of data collection assistants												
14	Data collection												
15	Data cleaning or validation												
16	Data Entry												
17	Data analysis												
18	Results presentation, write-up, and discussion												

19	Finalize dissertation write-up												
20	Submission of the bound dissertation to Supervisor for clearance for viva												
21	Viva-voce												
22	Submission of the revised dissertation to the department after the viva												
23	Submission of final dissertation after conference marking to the department for forwarding to the school of graduate studies												

Appendix 7: Definition of Variables and Their Scales of Measurement

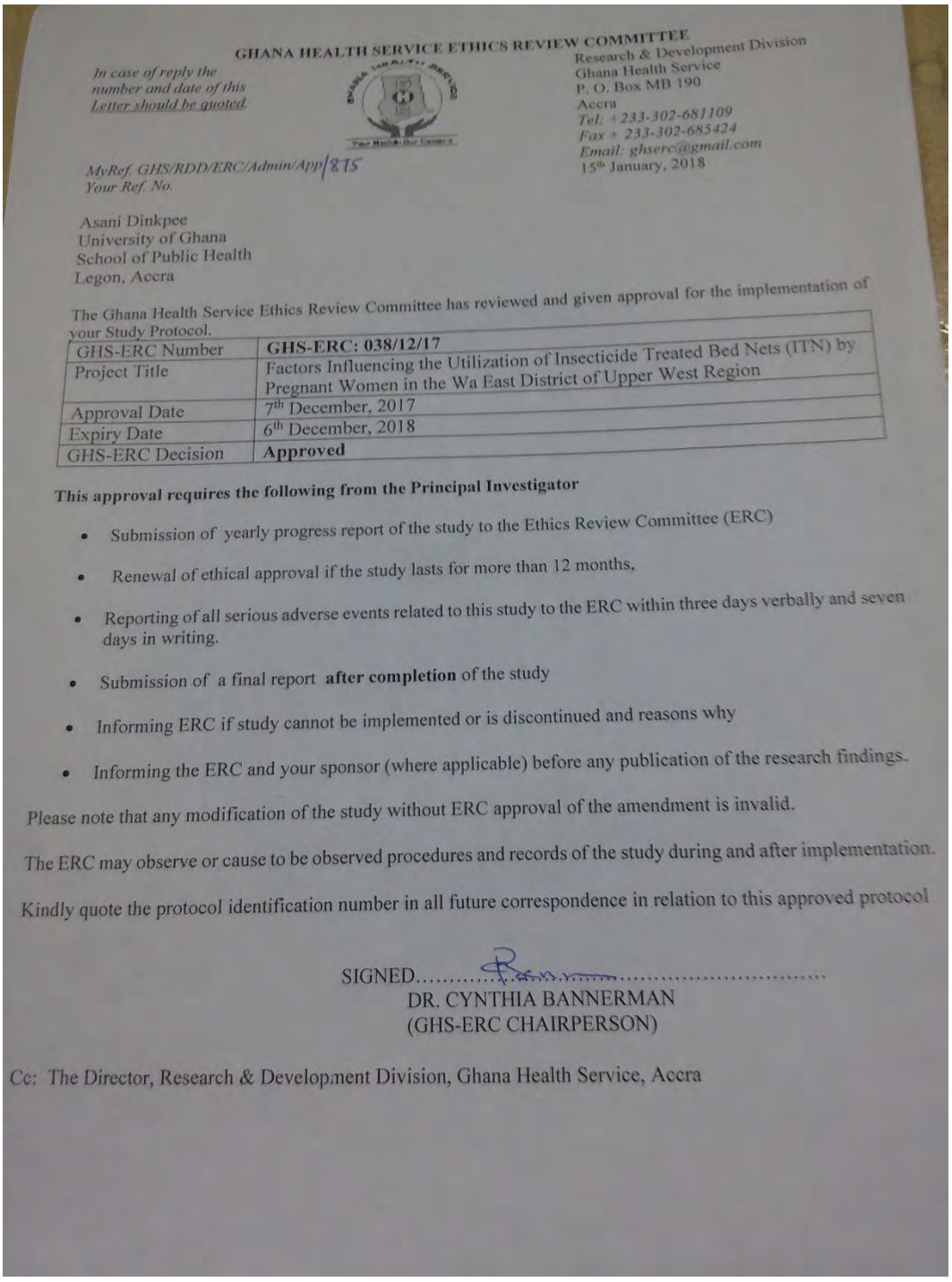
Operational definitions of variables and their scales of measurement

No.	Variable	Type of Variable	Operational Definition	Scale of Measurement	Objectives
1	Use of ITN	Dependent	A person who slept under an ITN the night before the interview	Nominal	One
2	Age	Independent	Age at last birthday of respondent on the day of the interview	Discrete	Two
3	Marital status	Independent	Marital status on the day of the interview	Nominal	Two
4	Religion	Independent	Religious affiliation of respondent on the day of interview	Nominal	Two
5	Ethnicity	Independent	Ethnic affiliation of respondent	Nominal	Two
6	Educational status	Independent	The highest level of education attained by respondents as at the day of the interview	Ordinal	Two
7	Occupational status	Independent	The kind of economic activity respondent usually do for a living	Nominal	Two
8	Parity	Independent	No of deliveries of respondent as at the time of interview	Discrete	Two
9	Rainy season	Independent	Period of year when there are rains – May-September	Nominal	Three

10	Dry season	Independent	Period of year when there are no rains – October-April	Nominal	Three
12	Chemical on net itches my skin	Independent	Skin rashes/itching (hypersensitivity) experienced by the respondent whenever she sleeps under an ITN.	Ordinal	Four
13	Discomfort-feel heat, warmth or sweats sleeping under ITN	Independent	Respondent feels warm and sweats when sleeping under ITN	Nominal	Four
14	Inadequate room/sleeping space to hang it	Independent	No space in the room to hang ITN	Nominal	Four
15	I don't own an ITN	Independent	Respondent doesn't own an ITN	Nominal	Four
16	My ITN is thorn	Independent	Respondent's ITN is thorn beyond sewing	Nominal	Four
17	Shares room with too many people	Independent	Respondent sleeps with many people in the room that it is practically impossible to hang and sleep under an ITN	Nominal	Four
18	Difficulty or stress in hanging ITN in room	Independent	Nature of room makes it impossible to hang an ITN	Nominal	Four

19	There are no mosquitoes	Independent	Respondents believe/ perception that mosquitoes density is insignificant	Nominal	Three
20	I use mosquito spray, coils, repellent instead	Independent	Respondent's use of alternative malaria control measures instead of ITN	Nominal	Four
21	Difficulty breathing under ITN	Independent	Respondent finds it difficult to breath (suffocates) when sleeping under an ITN	Ordinal	Four

Appendix 8: Ghana Health Service Ethical Review Committee Approval Letter



GHANA HEALTH SERVICE ETHICS REVIEW COMMITTEE

In case of reply the number and date of this Letter should be quoted.

Research & Development Division
Ghana Health Service
P. O. Box MB 190
Accra
Tel: +233-302-681109
Fax + 233-302-685424
Email: ghserc@gmail.com

*MyRef. GHS/RDD/ERC/Admin/App/*875
Your Ref. No.

15th January, 2018

Asani Dinkpee
University of Ghana
School of Public Health
Legon, Accra

The Ghana Health Service Ethics Review Committee has reviewed and given approval for the implementation of your Study Protocol.

GHS-ERC Number	**GHS-ERC: 038/12/17**
Project Title	Factors Influencing the Utilization of Insecticide Treated Bed Nets (ITN) by Pregnant Women in the Wa East District of Upper West Region
Approval Date	7th December, 2017
Expiry Date	6th December, 2018
GHS-ERC Decision	**Approved**

This approval requires the following from the Principal Investigator

- Submission of yearly progress report of the study to the Ethics Review Committee (ERC)
- Renewal of ethical approval if the study lasts for more than 12 months,
- Reporting of all serious adverse events related to this study to the ERC within three days verbally and seven days in writing.
- Submission of a final report **after completion** of the study
- Informing ERC if study cannot be implemented or is discontinued and reasons why
- Informing the ERC and your sponsor (where applicable) before any publication of the research findings.

Please note that any modification of the study without ERC approval of the amendment is invalid.

The ERC may observe or cause to be observed procedures and records of the study during and after implementation.

Kindly quote the protocol identification number in all future correspondence in relation to this approved protocol

SIGNED.....
DR. CYNTHIA BANNERMAN
(GHS-ERC CHAIRPERSON)

Cc: The Director, Research & Development Division, Ghana Health Service, Accra