Bed Nets Ownership Utilization and Malaria Trend among Pregnant Women in the Bamenda Health District; North West Region-Cameroon

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ABSTRACT

Introduction: Malaria is a mosquito-borne infectious disease affecting millions of people across the world especially children under five years and pregnant women. Long-Lasting Insecticide Treated Nets (LLINs/ITN) are an important malaria control tool and are freely distributed to pregnant women during Ante Natal Care. This study assessed the ownership and utilization of LLINs and malaria trend among pregnant women in the Bamenda Health District (BHD).

Materials and Methods: Data was obtained from the district database to develop the epidemiological profile of malaria in pregnancy while for prospective study, a quantitative cross-sectional survey was carried out in three health units in BHD. All eligible pregnant women present at the time of visit were conveniently used. Data was collected using a questionnaire. Chi-square and logistic regression were used to determine the relationship and association between the dependent and independent variables.

Results: Ownership of LLIN was 82.9% while usage was 71.5%. Our study revealed a positive association between bed net utilization and malaria occurrence among pregnant women. This association was influenced by several mediating factors such as demographic, sociocultural, socioeconomic variables, etc. Our study showed that pregnant women who have never been to school were 6.43 times more likely to contract malaria compared to those with a higher level of education. Pregnant women who sleep every night under a treated bed net has a protective effect of 18% (1.80-0.82*100). We also observed that the risk of contracting malaria is 1.48 times higher among those who believe that the mosquito net does not prevent malaria unlike those who believe the opposite. The risk of contracting malaria was 4.30 times higher when pregnant women do not own a net etc.

Conclusion: Nets utilization influences malaria occurrence among pregnant women in the BHD. Behaviour change communication strategies on LLINs use should be further targeted to improve LLINs utilization among pregnant women.

Key words: Bed Nets, Ownership, Utilization, Malaria Trends, Pregnant Woman.

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Introduction

Malaria is a life-threatening disease caused by a parasite that is transmitted to humans through the bite of the female Anopheles mosquito.[1] It remains a major public health problem worldwide, particularly in Africa where over 90% of cases are recorded. In 2015, it was estimated that 3.2 billion people – nearly half the world's population–were at risk of malaria.[2,3] In Cameroon, an endemic country, malaria remains a major public health problem as the entire population of over 20 million inhabitants is at risk, with 15 million people at a higher risk.[4] Pregnant women and children under five years of age constitute the most vulnerable group[3,5,6] Worldwide, an estimated 125 million pregnancies are at risk from malaria each year. Pregnant women are 1.5 times more susceptible to malaria infection than non-pregnant women and malaria infection can have devastating consequences on maternal, newborn, infant, and child health.[7]

In Africa, 10,000 women and between 75,000 and 200,000 infants are estimated to die annually as a result of malaria infection during pregnancy, and approximately 11% (100.000) of neonatal deaths are due to low birth weight (LBW) resulting from Plasmodium falciparum infections in pregnancy.[7] In the absence of malaria control in pregnancy, it is estimated that 11.4 million pregnancies would have experienced P. falciparum placental infection at some stage of pregnancy, accounting for 41% of the estimated 27.6 million live births in sub-Saharan Africa in 2010.[7] For pregnant women living in moderate-to-high transmission areas, World Health Organization (WHO) recommends intermittent preventive treatment at each scheduled antenatal visit after the first trimester.[8]

LLINs introduction has been followed-up by a sharp decrease of P. falciparum malaria morbidity[9] Long Lasting Insecticide-treated bed nets (LLINs/ITNs) are a cornerstone of malaria control in sub-Saharan Africa[3,10] Long-lasting insecticide-treated bed nets (LLINs)/ITNs are the major and most promising components of the selective vector control strategies.[11] LLINs have been proven in clinical trials and in-field programs to substantially reduce the adverse consequences of malaria in pregnancy, reducing maternal anemia, severe anemia, peripheral and placental malaria, and low birth weight, if effectively used by pregnant women.[7]

In Cameroon, several control measures have been put in place among which the use of bed nets (LLINs/ITNs) is considered one of the core vector control strategies. However, the greatest challenge includes ownership and utilization by pregnant women and its outcome. The World Health Organization, therefore, recommends periodic surveys to assess whether populations at risk receive sufficient LLINs/ITNs and that these are properly used.[10] Nevertheless, assessments on possession, utilization, and impact of LLINs in Cameroon have been limited and have not been done in the study area for long. The main objective of our study was to determine the relationship between bed net ownership, utilization, and the occurrence of malaria among pregnant women in the BHD.

Materials and Methods

Study Design, Period and Setting

A quantitative cross-sectional analytic study was used in this research. Both retrospective and prospective studies were carried out. Retrospective data was collected from the district malaria database to construct the

epidemiologic profile of malaria in pregnancy in the BHD and this mostly involved those who were tested positive following the RDT/microscopic test. While pregnant women consulting from November to December 2017 in health units where the study was carried out constituted the prospective study.

Participants and Sampling

The target population involved pregnant women living within the Bamenda Health District who consulted or attended Ante Natal Care (ANC) in any of the participating health facilities.

Inclusion and Exclusion Criteria

Pregnant women of all age groups were included in the study provided they met inclusion criteria which included; Pregnant women who consulted and were registered within 2011-2016 in the BHD, Pregnant women who consulted or who were admitted within November to December 2017 in the health facilities in which the studied was carried out in the BHD and All pregnant women in the BHD who were willing to freely participate in the study. The exclusion of criteria were pregnant women who refuse to participate.

Data Management and Data Analysis

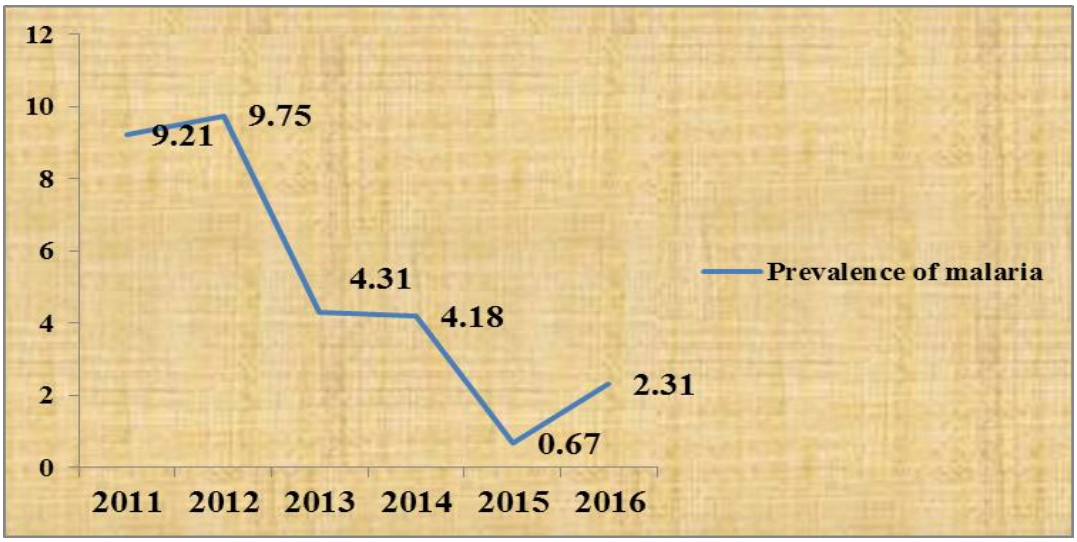
In this research, three types of data analysis software were used. These include SPSS 21, STATA 13, and Excel. The first mentioned software made it possible to do flat sorting of the variables, their recoding, bivariate analyzes, and to transfer the data to STATA. The latter software made it possible to come up with the binomial logistic regression model. Excel software allowed the drawing of tables and graphs. The results were presented and only statistically significant variables analysed. Odds ratios will be interpreted to show a possible association between the exposure and outcome. The significance was presented with the p-value also confidence interval.[12]

Ethical Considerations

To respect the medical ethical considerations, we ensure confidentiality, justice, and respect of all individuals during this research after explaining to participants the objectives of the study and the implications. Written consent was signed before participants stated the study. This study was approved by the Institutional Review Board of the School of Health Sciences, Catholic University of Central Africa No 2017/0619/CEIRSH/ESS/MSP. An authorization to conduct this research was granted by the Regional Delegate for Public Health North West Region No 734/RN/NW/RDPH. Authorization was also equally granted by the district chief of service for public health for Bamenda health district NO 859/L/NWR/RDPH/DHS BDA. Final approval is also given by facility heads.

Results

The increase in the number of mosquito nets distributed over the period 2011-2016(i.e. about 1823 surplus) was accompanied by a decrease in the number of malaria cases (7.50%) over the same period. However, following the overall trend, there is a fluctuation that emerges between 2011 and 2016 (between 2011-2012 and 2015-2016). There was a slight increase in cases of malaria that is 0.06% and 1.64% respectively (Graph1).



Graph 1: Trend in Malaria Prevalence from 2011 to 2016 in the Bamenda Health District.

The prevalence of malaria was highest in November 2012 (23.51%). followed by January 2012(20.83%). The months of May and June have an almost equal prevalence of 12.66% and 12.92% respectively. The lowest proportions of malaria victims were observed during the year 2015 and particularly in April (0.09) September (0.35%) and June (0.79%). In the other years, the distribution of malaria per month occupies an intermediate position (Table 1).

Months	Years					
	2011	2012	2013	2014	2015	2016
January	10.44	20.83	3.96	2.42	2.60	4.51
February	14.78	8.62	3.2	5.59	1.30	2.41
March	20.51	7.3	1.46	2.89	1.55	2.61
April	16.08	5.88	5.22	3.54	0.09	2.41
May	9.21	12.66	3.2	2.11	1.51	1.71
June	7.41	12.92	3.56	2.76	0.79	2.10
July	3.3	4.96	7.14	13.89	1.72	2.88
August	8.68	3.8	9.18	2.7	7.88	0.81
September	6.87	8.44	4.15	13.33	0.35	3.86
October	8.49	9.3	3.33	10.32	1.25	0.91
November	8.24	23.51	4.17	4.47	1.40	2.17
December	4.89	6.85	7.09	6.88	2.25	1.82

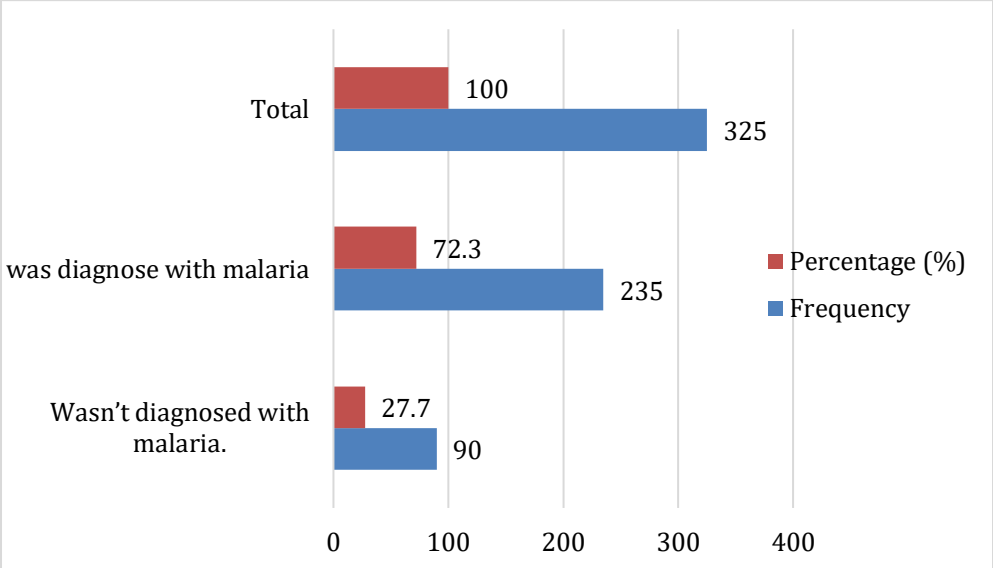
Table 1: Distribution of Pregnant Women with Respect to Malaria Prevalence per Month and Per Year

Considering the age variable, it shows that most of the respondent were women aged 15-30 230(70.6%), followed by those aged 31yrs+ 79(24.2%) while the proportion of those less than 15 was the lowest 17(5.2%). In terms of educational level, 136(42.0%) were of University level, followed by secondary level 80(24.7%), primary 50(15.4%), higher level 34(10.5) while the proportion of pregnant women who have never been to school was 24(7.4%). As concerns marital status, 241(74.9%) of pregnant women were married compared to 23.1% who were single. The proportion of those who were divorced / widow was low i.e. 5(1.5%) and 4(1.2%) respectively. In terms of place of residence, 227(73.0%) of pregnant women live in urban areas, unlike those living in rural areas were 84(27.0%) (Table2).

Demographic Variable	Frequency	Percentage (%)
Age		
Less than 15 years	17	5.2
15-30 years	230	70.6
31 years and above	79	24.2
Total	326	100.0
Educational level		
Never being to school	24	7.4
Primary	50	15.4
Secondary	80	24.7
High school	34	10.0
University	136	42.0
Total	324	100.0
Marital status		
Single	75	23.1
Married	241	74.9
Divorce	5	1.5
Widow	4	1.2
Total	325	100.0
Type of settlement		
Rural	84	27.0
Urban	227	73.0
Total	311	100.0

Table 2: Distribution of Pregnant Women According to Demographic Variables

Out of 325 women surveyed, 235(72.3%) of pregnant women had been diagnosed with malaria during the last five years. The proportion of those who were not diagnosed with malaria at the time of the survey is not negligible i.e. 90(27.7 %.) (Graph 2).

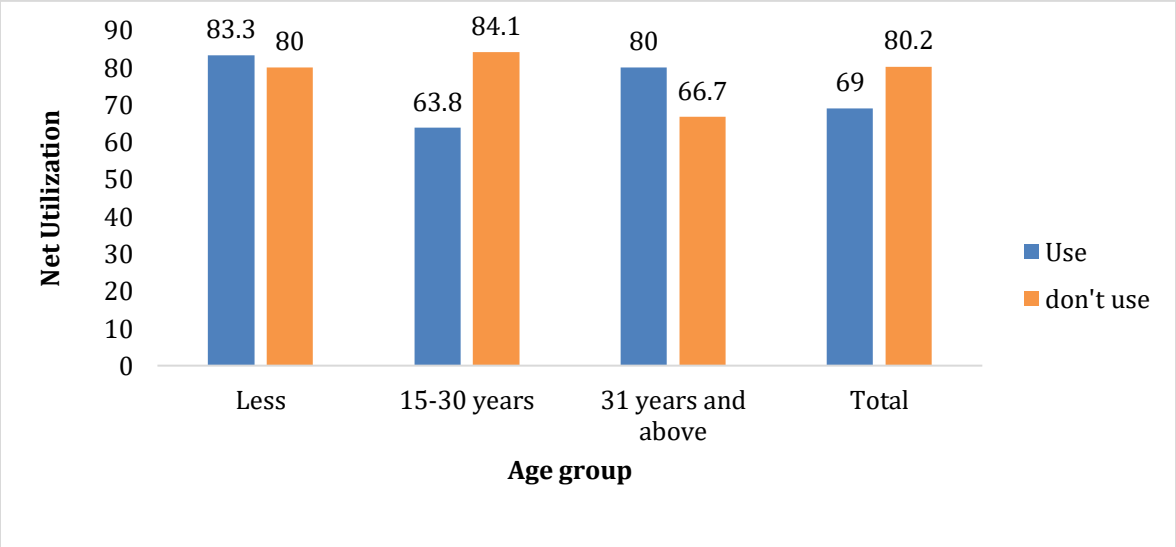


Graph 2: Distribution of the Dependent Variable in the Sample.

Bivariate Analysis

The bivariate descriptive analysis allows us to identify the degree of association between the study variables. To this effect, we will first examine the relationship between the use of bed net and the occurrence of malaria, then control this relationship with the other variables. The critical probability threshold used in this study is 5%. We keep in mind that if P-value is less than 5%, we reject H0 (null hypothesis) and we conclude that there is a relationship between the two variables.

Malaria occurrence and net use are significantly associated with the 15-30 age group (P = 0.03). The highest prevalence is recorded when pregnant women do not use the net (84.1%) than when they use it (63.8%)(Graph3).



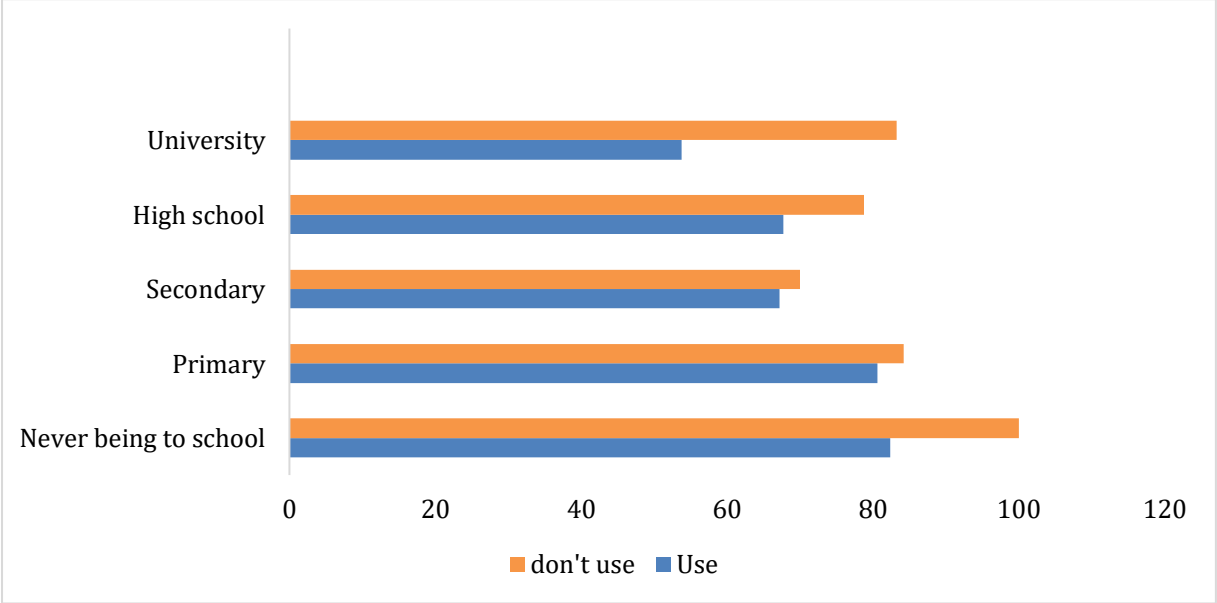
Graph 3: Prevalence (%) of Malaria According to age Group of Pregnant Women.

There was a significant association with the 5% threshold between bed net use and malaria occurrence (P = 0.04> 0.05). It also shows that the prevalence of malaria is high among pregnant women who do not use the net (80.2%) than among those who use the net (69.0%) (Table3).

Bed Nets Utilization	Malaria Prevalence					
	Not Diagnosed with Malaria		Was Diagnosed with Malaria		Total	
	(N1= 89)		(N2=229)		(N=318)	
	n1	%	n2	%	n3	%
Use	72	31.0	160	69.0	232	100.0
Don't use	17	19.8	69	80.2	86	100.0
P- value	0.04					

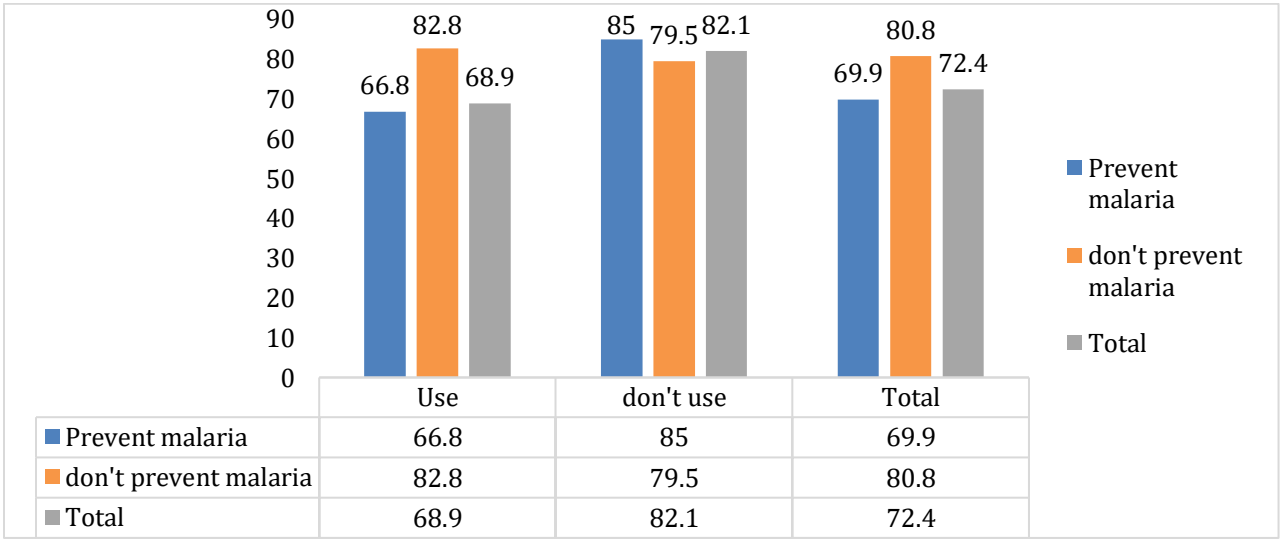
Table 3: Association between Malaria Prevalence and Mosquito net use Among Pregnant Women in the Bamenda Health District

The association between net use and malaria prevalence is associated with a 5% threshold in pregnant women who have never being to school. The prevalence of malaria in this category is higher among women who do not use the net (100%) than among those who use it (82.4%). Regardless of the level of education, malaria prevalence is higher when women do not use the bed net. The lowest prevalence was observed among pregnant women with a higher level of education (53.8%) in Graph 4.



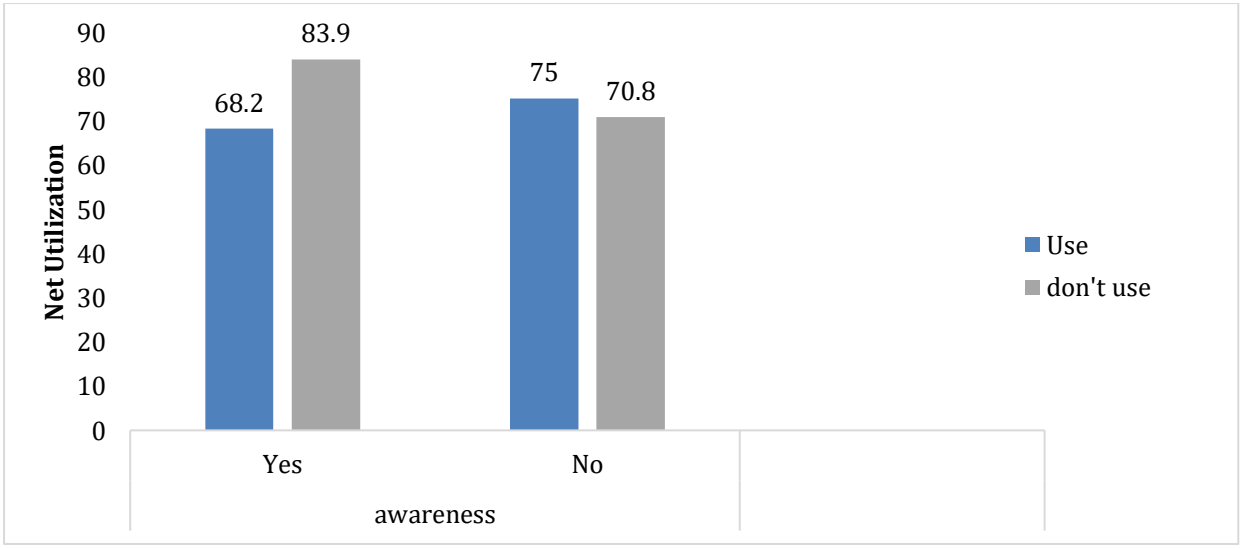
Graph 4: Prevalence (%) of Malaria According to Educational Level of Pregnant Women

The use of bed nets and the prevalence of malaria among pregnant women is significantly associated with the 5% threshold for pregnant women who believe that bed net can prevent malaria. The prevalence of malaria is higher among those who believe that the bed net does not prevent malaria (82.8%) than among those who think the opposite (66.8%) (Graph 5).



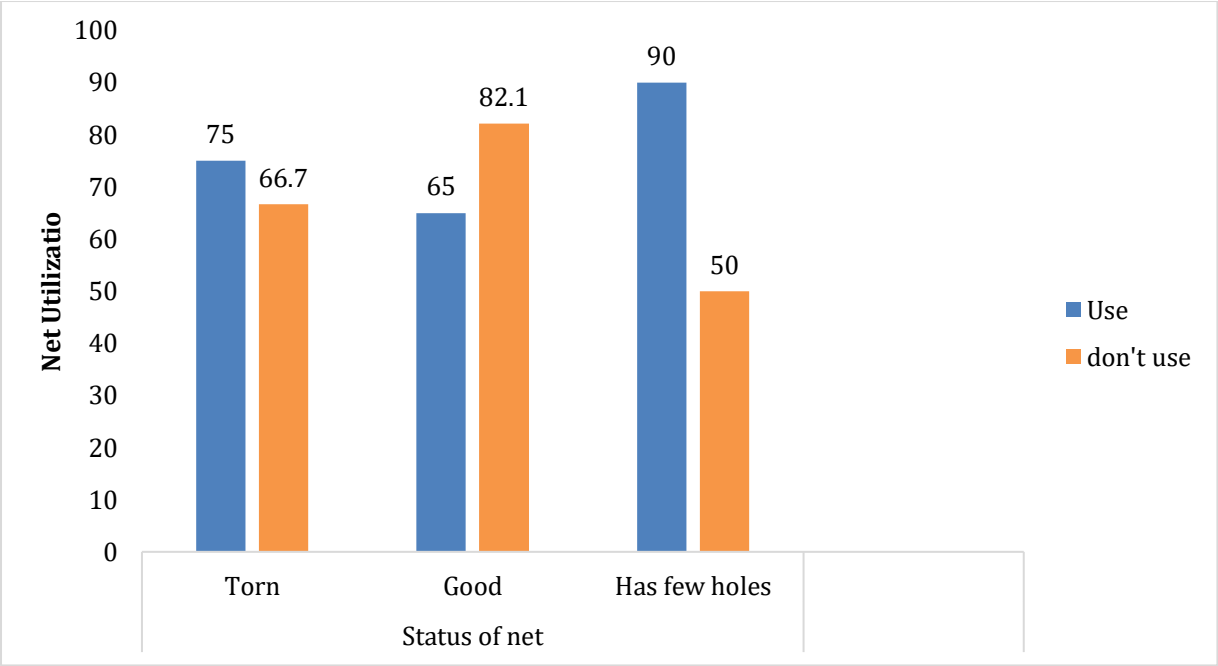
Graph 5: Relationship between Net use and Malaria Prevalence in Function to Pregnant Woman's Perception of Bed Nets

Nets use and malaria prevalence among pregnant women after controlling for pregnant woman's awareness are significantly associated with the 5% threshold in the pregnant women who were aware of the mosquito nets. The prevalence of malaria remains low for this category of women (68.2%) compared to 75.0% for those who were not aware (Graph 6).



Graph 6: Relationship between net use, Malaria Prevalence and Mosquito net Awareness.

The association between the state of the net and the prevalence of malaria is significantly associated with the threshold of 5% and especially when the woman has a mosquito net in good condition. The more pregnant woman sleeps under a mosquito net in poor condition (torn, few holes), the higher the prevalence that is 90.0%. This prevalence is low when the pregnant woman uses a mosquito net in good condition 75.0% (Graph 7).



Graph 7: Prevalence of Malaria and Bed nets status.

Discussion: Analysis of malaria prevalence 2011-2016, shows that there was an increase in the number of mosquito nets distributed over the period 2011-2016(i.e. about 1823 surplus) which was accompanied by a decrease in the number of malaria cases (7.50%) over the same period. This could mean that the nets distributed were used by pregnant women. However, the overall trend showed a downward (decreasing) trend though with some fluctuations that emerged between 2011-2012 and 2015-2016. This increase could be due to factors such as a decrease in the number of mosquito nets distributed, it could also be due to decrease or relaxation in the awareness-raising initiative by health personnel or low awareness of pregnant women and family members on the influence of non-use of bed net on malaria occurrence. These results were correlated to results of another study conducted in Cameroon were there has been an overall reduction from 41% in 2008, through 36% in 2010 to 31% in 2011 while malaria-related deaths reduced from 29% in 2009 to 19% in 2011,[13] which was also the case in a study conducted in Africa which states that; 'there is mounting evidence across Africa that the increasing level of malaria interventions have led to a reduction in malaria prevalence from 37% in the years 1985–1999 to 17% in 2000–2007 and a consequent decline in morbidity and mortality".[13] This has been brought about through combining ACT and vector control using long-lasting insecticidal nets (LLIN).

Also, results of another study conducted in the Mbakong Health Centre in the North West Region (NWR) Cameroon showed a similar malaria trend that is between 2006 and 2012 confirmed malaria positive cases (taken here as a percentage of those tested) fluctuated, dropping steadily from 356 (53.21%, 95% CI 0.49-0.57) in 2006 to 93 (17.20%, 95% CI 0.14-0.20) in 2008 and then gradually rose to 244 (35.00%, 95% CI 0.31-0.39) in 2011 and finally dropped to 91 (18.20%, 95% CI 0.15-0.22) in 2012. [13] While the lowest and peak prevalence in this study where observed in 2015 and 2011 respectively, those obtained in the [13] showed the lowest and peak values in 2008 and 2011 respectively. Thus 2011 in both studies showed the highest malaria burden. No seasonal trends were observed. Overtime (taken as observations in a month as well as quarters) there was a significant and practically relevant fluctuating but progressive decline in prevalence.

The level of education influences the use of a bed net and thus influences the risks of pregnant women to contract malaria. Pregnant women who have never being to school are 6.43 times more likely to contract malaria compared to those with a higher level of education. This means that this variable mediates the effect of the relationship between bed net utilization and the occurrence of malaria among pregnant women in the Bamenda Health District. This result was in line with a similar study carried out in the BHD of Cameroon that showed that there was an association between bed net utilization and the educational level of the household head thus influencing malaria occurrence.[11] Similar results were also obtained in a study carried out in the Cross-River state of Nigeria, Ibadan Nigeria which showed that women who had at least senior secondary school education are more likely to own and use bed net than their counterparts with a lower level of education. In another study carried out in the Ho Municipality of Ghana, results showed that the level of education significantly influenced LLIN ownership (p=0.003) and utilization (0.020) thus influencing malaria prevalence among pregnant women.[14] This can be explained by the fact that educated pregnant women may be better able to appreciate the importance of using nets in malaria prevention and to understand the information included in the public awareness campaigns and information received from ANC which will eventually influence bed net usage thus reducing malaria prevalence.

The type of settlement influences the relationship between the use of bed net and the occurrence of malaria in pregnant women. Everything being equal, pregnant women living in rural areas are 1.45 times more likely to contract malaria than their resident counterparts in urban areas. The results of this study were similar to the results of another study carried out in the country were malaria parasitaemia prevalence was higher in rural (adjusted OR = 1.63, 95%CI = 1.07–2.49) compared to semi-urban settings.[11] The greater risk of malaria parasite infection in rural settings reported here may be due to their specific characteristics that may facilitate human–mosquito contacts. This may accrue to the differences in housing types. The keeping of farm animals, particularly pigs, and the absence of health facilities may also account

for the higher malaria parasitaemia in rural settings.

The age of the mother influences the occurrence of malaria in pregnant women. Pregnant women aged 31 and above are 4.15 times more likely to contract malaria compared to their counterparts aged 15-30years. This risk increases by 6.33 times in the under-15 category. This partly in line with results of a study conducted in the NWR of Cameroon which states that malaria prevalence turns to decrease with increasing age (that is from the below 15 years age group to the 15-30 age group in this our study)[13], and another study carried out in the country also report that malaria parasitaemia prevalence was higher in those below 15 years compared to those 15 years and above. This is corroborating with an earlier finding in Tanzania that malaria prevalence decreases with age. While another study carried out in the Ho Municipality of Ghana claims that there was an association between aged 26-36 years and utilization of LLIN compared to those aged 15-25 years [OR=0.45 (95% CI: 0.23-0.90; p=0.023][14]. The decreasing malaria prevalence with increasing age could be as a result of the partially acquired immunity cumulated with age and repeated infections with the Plasmodium parasites. While the 31+ group malaria increase prevalence in this study may be a result of negligence on the part of the pregnant woman to effectively use a bed nets.

The fact that a pregnant woman sleeps every night under a treated bed net has a reducing effect of 18% (1.80-0.82 * 100) of being at risk of malaria. Nevertheless, this risk is higher in pregnant women who do not sleep under a mosquito net every night as opposed to those who do. Results of this study show 182(71.5%) of pregnant women slept under bed net a night before the survey. The result obtained on previous night usage of ITNs in this study is higher compared to 69% obtained in the BHD[4], 58.3% (466/799) reported in the country,[11], 139 (61%) reported in Ghana[15] and 52.3% (361) in Ethiopia and 35.3% use of an insecticide-treated net (ITN) the previous night among pregnant women across 37 countries for 2009–2011 (range, 5.2%–75.5%);[7] but this was lower than 73.3% in Harari.[16] All of these studies reported a higher malaria occurrence in those who did not sleep under the bed net every night compare to those who did. Results of this study are also similar to results obtained in a study in sub-Saharan Africa which states that; In the absence of malaria control in pregnancy, it is estimated that 11.4 million pregnancies would have experienced P. falciparum placental infection at some stage of pregnancy[7] and another study still in sub-Saharan Africa which estimates that malaria control interventions accounted for 70 % of the 943 million fewer malaria cases occurring between 2001 and 2015, averting 663 million malaria cases. Of the 663 million cases averted due to malaria control interventions, it is estimated that 69 % of cases averted were due to effective use of ITNs/LLIN.[8]

The analysis of this study shows that it is important to consider pregnant women's perception and its effect on the relationship between net use and the occurrence of malaria among pregnant women. It shows that the risk of contracting malaria is 1.48 times higher among those who believe that the bed net does not prevent malaria unlike

those who believe the opposite. Results of a study carried out in Ethiopia shows that HHs with no knowledge of prevention of malaria comprised 64.3%, and were less likely to use ITNs than their counterparts, with COR (95% CI) of 0.36 (0.26–0.49).[17] In another study in the River state Nigeria, respondents viewed ITNs as a good preventive measure (80%) and the chances of contracting malaria in those who were aware were less than those who were not.[18] Awareness of pregnant women about malaria prevention was a significant predictor of ITN use and consequently malaria occurrence.

Women who are knowledgeable are 40% less likely to have malaria compared to women who have no knowledge of net treatment options. Results of this study are in conformity with results of another study conducted in Uganda where pregnant women who reported to be aware of ITN treatment were 1.65 times more likely to utilize ITN and are protected from malaria than those who were not aware of ITN (P-value = 0.004).[19] This could be because those who are over washing end up destroying the insecticide use in treating the bed net with.

The availability of the net influences the relationship between the use of the net and the occurrence of malaria in pregnant women. Everything being equal, the risk of contracting malaria is 4.30 times higher, when pregnant women do not own a net. This result is similar to another study carried out in Calabar Nigeria where about two-thirds of the respondents who do not own at least a nets stated that 'nets were not available' as a reason for not having one. For most of them, the non-availability of the nets meant they did not know where/how to get one. Other reasons given for not having a mosquito net included: 'does not like to use net' and 'there is no mosquito in my residence'.[20] Misconceptions about the causes of malaria and prevention modalities may be also valid reasons for non-ownership and utilization of nets.

Access to mosquito nets is a factor that influences the occurrence of malaria in pregnant women. Women who report that they do not have easy access are 1.49 times more likely to have malaria than their counterparts who believe the opposite. This result is correlated to another study that says that about two-thirds of the respondents who do not own at least a net stated that 'nets were not available' as a reason for not having one and this predisposes them to malaria. For most of them, the non-availability of the nets meant they did not know where/how to get one.[20] Another study found that accessibility to ITNs also positively affected the usage of ITNs by pregnant women. Thus, if the net is not accessible to pregnant women, no matter the knowledge they have on malaria prevention with the use of bed net will serve no purpose thus is of great importance that these nets should be made available at all moment to all and especially pregnant women.

Conclusion: Malaria remains an important public health problem. Pregnant women and newborns living in malaria-endemic areas are especially vulnerable. Malaria in pregnancy (MiP) continues to play a large role in global maternal deaths. Bed net especially long-lasting insecticidal nets (LLINs) is an important malaria control tool and when effectively used by pregnant women, it goes a long way to curb the rate of malaria in pregnancy. This study aimed to

determine bed net ownership, utilization, and malaria trend among pregnant women in the BHD. Bed net utilization influences malaria occurrence in the Bamenda health district through the following variables: demographic (age of pregnant women, level of education and place of residence), economic (Possession of the mosquito net) socio-cultural (Perception of bed net use on malaria prevention, Net status, Sleeping under a bed net every night, Information on how to treat net and, Season in which pregnant women prefer to sleep under LLLINS/ITN.) and at the level of health care services offered (Accessibility to mosquito net).

Authors Contributions

JY, YMOB, and CFT conceived of the study. JY and CNN participated in the analysis of the samples, data management, and statistics. JY and CFT drafted the manuscript. All of the authors read the manuscript and approved the final version prior to submission.

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