



Factors Influencing the Utilization of Insecticide Treated Bed Nets in the Prevention of Malaria in the Berekum East Municipality, Ghana

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Authors' contributions

This work was carried out in collaboration between all authors. Author PG designed the study, performed the statistical analysis, wrote the protocol, and wrote the first draft of the manuscript. Authors EBA and DBS managed the analyses and editing of the study. Author RO managed the literature searches and ethical clearance. All authors read and approved the final manuscript.

Article Information

DOI: 10.9734/AJRID/2023/v13i2259

Open Peer Review History:

This journal follows the Advanced Open Peer Review policy. Identity of the Reviewers, Editor(s) and additional Reviewers, peer review comments, different versions of the manuscript, comments of the editors, etc are available here: <https://www.sdiarticle5.com/review-history/99330>

Original Research Article

Received: 22/02/2023

Accepted: 25/04/2023

Published: 04/05/2023

ABSTRACT

Introduction: The goal of the study was to assess the factors that influence the utilization of Insecticide Treated bed Nets (ITN) in the prevention of malaria in the Berekum East Municipality.

Methods: Quantitative cross sectional design was used to conduct the study in the Berekum East Municipality. Total of 307 respondents aged between 20-60 years were randomly selected for data collection with the aid of a questionnaire. Data were analysed with Statistical Package for the Social Sciences (SPSS) version 23.0. Descriptive and logistic regression analyses were used to examine the factors influencing ITN use at 95% confidence interval.

Results: The study found that 87.6% of the respondents owned ITN; however 28% of them used it regularly while 72% use it irregularly. Only 12.4% of the respondents did not use ITN because they

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did not have them. Majority of the respondents (94.4%) had sufficient knowledge about INT. The reasons that prevented the people from using the ITN included inconvenienced sleeping under them, skin rashes and heat intolerance. The key predictors of appropriate use of ITN were education level, the number of occupants per room, the structure of the room and the knowledge level and the availability of ITNs. Age range 20-30 year had odds ratio of 1.633 of using ITN than other age groups. Likewise, people with tertiary education had OR 2.036 ITN usage more than other educational categories.

Conclusion: There was high ITN ownership with poor usage. Strengthening health education of the benefits and importance of ITN use will improve appropriate utilization of ITN among the people of Berekum Municipality.

Keywords: Hemoprotozoan; resistance; barrier; endemic; vector control.

1. INTRODUCTION

1.1 Background of the Study

Malaria-related mortality is excessively high in Africa, particularly Ghana. Malaria is a preventable and treatable illness, but it remains one of the world's most serious public health issues [1]. Malaria is a leading cause of morbidity and mortality worldwide, especially in Tropical Africa, where it accounts for at least 90% of malaria mortality [2]. People living in malaria-endemic countries in sub-Saharan Africa account for more than three-quarters of all malaria deaths worldwide [3]. In 2019, there were an estimated 207 million cases of malaria, with 627000 deaths (according to the World Health Organization) [4]. Malaria is also a major cause of global morbidity and mortality. Malaria mortality in children have decreased by 40% since 2000, but children under the age of five still accounts for 78% of global malaria mortality, or 456000 a year [5]. This translates to over 1,200 children dying from malaria every day and 50 children dying every hour [6].

According to Ghana's first quarter survey, 54 people died from malaria between January and March 2020. A total of 1,001,070 cases of malaria were reported, accounting for more than half of the 2,346,677 suspected cases tested by the Ghana Health Service [7]. There were 21,201 children under the age of five and 28,764 pregnant women in the total. Furthermore, children under the age of five accounted for 42% of the 58,775 malaria admissions. Sixteen of the fifty-four deaths resulted among children under the age of five, accounting for almost a third of the total [8].

The most commonly used malaria prevention method is to sleep under an insecticide-treated net (ITN) [9]. In 2018, 54% of malaria-affected people in Sub-Saharan Africa slept under an ITN,

up from 30% in 2016. However, since 2015, the rate of growth in ITN coverage has slowed, and less than half of sub-Saharan African households have enough nets for all inhabitants [10]. ITNs, especially long-lasting insecticidal nets (LLINs), are a cost-effective way to avoid malaria in at-risk populations [11]. ITNs can minimize malaria transmission by up to 90% and all-cause mortality by up to 44% when used consistently [12]. Since the year 2000, over one billion nets have been shipped to Africa alone. ITNs accounted for 63% of the US\$1.6 billion spent on malaria commodities in 2014, or about \$1 billion [13]. Taxes and tariffs on nets, netting material, and insecticides have been waived in almost half of African countries. Since 2002, African countries have been increasing the number of mosquito nets distributed for free or at a low cost [14]. As a result, mosquito net coverage in African countries has increased significantly, with Ghana being no exception.

Physical geography as well as people's habits are all environmental factors that contribute to malaria susceptibility. There is a connection between mosquito density and the atmosphere [15]. The abundance of malaria infection may be due to factors such as favorable vector breeding grounds, low altitude, and high temperature. The majority of pregnant women sleep under an ITN during the rainy season, but some refuse to do so when the weather is mild or humid, particularly when the temperature is above 30°C. It was discovered that some of the homes had small openings, resulting in inadequate ventilation. Lack of energy in their homes was one of the obstacles that caused them to resist ITN. Because of the sun, they find it difficult to sleep in the net, while others have electricity but cannot afford to buy a fan [16].

Human behavior is linked to the likelihood of infectious diseases like malaria, and is determined by socio-demographics, economic

status, and cultural influences. Education, wages, and lifestyle are all important socio-demographic, economic, and cultural factors that influence the spread of malaria. These factors may have an impact on malaria prevention measures like the use of treated bed nets, commitment to therapies, and care seeking behavior [17].

A research on socioeconomic determinants of malaria transmission risk was performed by [18]. They wanted to see whether socio-demographic variables like awareness and schooling, as well as income status, had an impact on malaria transmission because there was little research on the topic. The research was carried out in an Orange-endemic primary health center in India. The thesis relied on a cross-sectional poll. The report found that people of poor social and economic status had a higher rate of malaria transmission. The presence of malaria was also linked to education and understanding of the disease. However, it was discovered that the participants' educational degree had little bearing on the disease's dissemination.

Malaria infection is difficult to control due to the mosquito vector's and malaria parasite's high adaptability. Malaria infection can be controlled through a variety of methods, all of which are aimed at either the malaria parasite or the parasite-carrying mosquito vectors. Vector control strategies consider actions aimed at the malaria infection vector, with the goal of reducing the vector's ability to transmit malaria by protecting transmission receptive areas. The use of insecticidal treated mosquito nets by those at risk in malaria prevention is one of the main malaria vector control methods [19]. ITNs work to deter malaria infection by creating a physical protection against mosquito bites, as well as pesticides that repel or destroy mosquitos. The universal distribution of ITNs has been implemented by the majority of malaria prevention programs. Because of their efficacy in avoiding mosquito bites, the WHO encourages the use of ITNs among people at risk of malaria in areas where ITNs are available [20].

ITNs were distributed by a variety of organizations, including research organizations, non-governmental organizations, private companies, and government agencies, particularly in Africa. This is largely due to the proven effectiveness of insecticide-treated nets in preventing vector-borne diseases like malaria, which is linked to higher mortality and morbidity.

Despite the contributions of numerous organisations, there are already significant differences in coverage [21].

The lack of ITNs has been identified as a limiting factor in the use of insecticide-treated nets in many reports. Non-ownership of ITNs was cited as the second most common explanation for caregivers not using ITNs for children under the age of five in a survey [22]. Awareness of the importance of using insecticide-treated nets is one factor that influences the use of insecticide-treated nets. Awareness of the causes of malaria and the disease's prevention strategies is a key factor that influences the use of ITNs [23].

Many people and key informants know that there are various ways of preventing malaria. Some people are able to emphasis on cleaning bushes around homes, keeping good environmental hygiene, disposing of empty tins and broken pots, draining away stagnant water, pouring oils on water ponds, digging deep pit latrine, closing windows and doors in the evening and eating proper diet to make the body strong. People are not putting into effect with any of these experiences. One of the most important factors in raising the use of ITNs to combat malaria has been health education [24]. The media, especially television and radio, as well as the use of mobile community information vans and health workers, were established as the key sources of information in assisting people in the community in preventing malaria. Continuous education and constant reminders, according to the community, will undoubtedly bring about the desired change. Most people are difficult to deal with, and they require more education to encourage them to change and practice using ITN [25].

Despite these investments, the disorder continues to be one of Ghana's leading causes of morbidity and one of the top five causes of morbidity in the Berekum East Municipality [26]. The concern arises as to whether mosquito nets are not spread evenly in the municipality, or whether people continue to use them, or whether the nets' efficacy in combating malaria is questioned. As a result, the emphasis of this study is on the factors that affect the use of insecticide-treated nets in the Berekum East Municipality for malaria prevention and control.

Malaria prevalence has been confirmed to be on the rise around the world, with Sub-Saharan Africa bearing the brunt of the disease's morbidity [27]. Malaria in Ghana accounts for 4%

of the global burden and 7% of the malaria burden in West Africa according to WHO [28]. Malaria-related mortality, on the other hand, has decreased dramatically from 19 percent in 2010 to 4.2 percent in 2016 [29]. Between 2010 and 2016, the case fatality rate for malaria in children under the age of five fell from 15% to 4%. Despite these achievements, malaria admissions rose from 280000 to 340000 people from 2000 to 2017 [30]. In the Berekum East Municipality, the use of insecticide-treated nets has not been able to address the issue head-on, as malaria remains a major concern [31]. The condition is also one of the most often identified diseases in emergency rooms [32]. Which factors continue to increase the prevalence of malaria in the municipality? It was against this gap that this study was conducted to identify the usage and factors including availability, knowledge and relationship between sociodemographic characteristics of respondent and the use of ITN in Berekum municipality. The findings of this study have added to the existing body of knowledge in areas where malaria prevention is difficult as well as other factors that affect ITN use. This study's findings have been useful to the Municipal Health Management Team, Non-Governmental Organizations, and other businesses engaged in the promotion of ITNs to fight malaria cases.

2. METHODS

2.1 Study Area

The study was conducted in Berekum East Municipality which is part of the Bono region of Ghana. Berekum is both the historic and administrative capital of the Municipality. It has a total population of 106716 for both sexes [33]. There are 64 percent urban settlements and 36 percent rural settlements in the municipality. Males and females account for 46.2 percent and 53.8 percent of the population, respectively [34]. In the Municipality, about 67% of the population is economically employed. Agricultural operations account for the majority of the region's economic activity. Agricultural operations employ about 57% of the overall population [35]. The municipality has a number of health infrastructures. Two hospitals, four nursing centres, four private health clinics, including maternity homes, and nine Community-based Health Planning Services (CHPS) are among the facilities [36]. The municipality has a number of health infrastructure. Two hospitals, six health

centres, seven private health clinics, including maternity homes, and eleven Community-based Health Planning Services (CHPS) are among the facilities [37].

2.2 Study Population

The research was conducted on a total population of about 155716 people. Adults aged 20 to 60 were the main target population. The researcher used households in the Berekum East Municipality. Fifteen (15) communities were used for the study.

2.3 Study Design

A descriptive cross-sectional study design was adopted for this research work. This study was a non-experimental observational study and did not involve manipulation or subjecting variables to a treatment. The research participants in this form of design were chosen based on the study's inclusion and exclusion criteria. At the same time, the participants' effects and exposures were analyzed. This study design is suitable for population-based research and determining the occurrence of a certain outcome. It may also be used for monitoring and planning of public health. This method worked well for gathering quantitative data on the study participants. This design was considered for this study because it identifies present conditions and points to recent needs. It was appropriate for determining the availability of insecticide-treated nets (ITNs), determining the extent of ITN use, assessing the level of expertise in malaria prevention, assessing the expectations of ITN use in malaria prevention and determining the factors that affected ITN use. It emphasized necessary information about a population's values, views, behaviors, and motives.

2.4 Sample Size

Kish, Liesh formula was adopted to determine the sample size of the study. The formula considers the normal distribution value of the confidence level "Z", the proportion of population with the target characteristics "p", and margin of error "e". A ninety-five percent (95%) confidence level (Z=1.96) and a 6% (0.06) error margin was used. And 50% (0.5) is used if "p" has not been established. The sample size was calculated using;

$$n = \frac{Z^2 p(1-p)}{e^2}$$

$$n = \frac{(1.96)^2 0.5(1 - 0.5)}{(0.06)^2}$$

This indicated that 267 minimum participants were required for the sample of this study; however, there was 15 percent of non-respondent rate in addition to total 267 participants making 307 sample size. Three hundred and nineteen (307) study subjects were therefore used for this research study.

2.5 Sampling Procedure

Berekum Central, Kato, Biadan, Mpatasie, Jinijini, Zongo were among the fifteen (15) communities from which 307 participants were chosen. Stratified and simple random sampling methods were used to pick different houses in each neighborhood visited. This was achieved by selecting respondents based on the population size of the communities. A lottery system was used by writing the house numbers on pieces of paper for the selection. Within the household members were made to pick folded papers containing "yes or no". Those who picked 'yes' were included in the study. This was continued until the required sample size was met. These methods were used because they are cost-effective, convenient, and simple when considering the study's population and sample size. The aim of these approaches was to gain easy access to the target population.

2.6 Variables of the Study

The study variables were clustered into independent and dependent variables. The independent variables factors influencing the usage of ITN which included: ownership of ITN, knowledge, availability and sociodemographic factors. On the other hand, usage of ITN was the main dependent variable for the study.

2.7 Data Collection Tools and Technique

The primary data were gathered to answer the research questions. This was accomplished by the use of a well-structured questionnaire. The questionnaires were designed to discuss the study's stated objectives. Multiple answer questions and a five-point Likert scale were used to create the closed-ended questions. This made it possible to do a quantitative analysis of the data with ease. There were five pieces of the questionnaires. In section A, data on social demographics were gathered. Participants' age,

ethnicity, educational level, profession, and monthly income were among the factors considered. The aim of Section B was to collect data on the availability and usage of treated insecticide nets in the Municipality. Section C looked at the reasons that influenced the usage of insecticide-treated bed nets in the Berekum East Municipality.

2.8 Pre-testing

Pre-testing of the study instrument was done in the Sunyani West Municipality. The pre-test municipality was situated outside the study area, but in terms of personnel and resources, it had similar characteristics. The pre-testing helped classify certain difficulties that were linked to the understanding of the respondents. The researcher pre-tested the questionnaire on 20 adults to check for reliability of the instruments. The Cronbach Alpha co-efficient was calculated and yielded 0.855 making the research instrument valid and reliable.

2.9 Data Management

The quantitative data were coded, cleaned and keyed into SPSS version 23.0 for analysis. The Logistic regression was conducted to assess the relationship between the factors and use of ITN using a 95 percent confidence interval and alpha= 0.06 significance level. In order to enter any oversight data, incomplete data were resolved by referring to the primary data. Any information that was actually absent from the primary data was omitted. The investigators made sure respondents completed all items on the questionnaire before submission to minimize missing data.

The data collected were made available to members of the research team (principal investigator and other authors). Data collected through recordings and field notes were coded to ensure anonymity and protect the privacy of respondents. The researcher kept records of data, time and place of interview. Participants were identified by pseudonyms which were written in the files kept for every participant.

2.10 Data Analysis

Before and after leaving the respondents, the collected data were clean. Uniformity, precision, continuity, legibility, and comprehensibility were all tested by the researcher. The SPSS software version 23 was used to code and tabulate the

data. The results of the descriptive research on the different variables were displayed in tables as percentage and frequencies. To define the relationship between different variables, ITN was used to measure the Chi-Square test and P-value. Some of the dependent variables include awareness of how to use ITNs, influences that influence use of ITN.

3. RESULTS

3.1 Sociodemographic Characteristics of the Respondents

Table 1 shows respondents' sociodemographic characteristics. With total sample size of 307, most 181 (58.9%) of the respondents were aged 51-60 years. There were more females 183(59.6%) than males who participated in this study with more than half 218 (71%) being

married. Majority 132 (43.0%) of the study participants had Junior High education and more than half 208(67.8%) were farmers. Most 222 (72.3%) of the study participants had a monthly income of less than 200 Ghana Cedis. Majority of the participants 125 (40.7%) had more four rooms in a household.

3.2 Usage of ITN among Residents

Table 2 shows the usage of ITN among respondents. Out of 307 respondents only 269 (87.6%) said they use the ITN. About 76 (28%) from the 269 participants said they always use it while 193 (72%) of the participants said they sometimes used it. Majority of the respondents 218 (81%) said they have used the ITN for less than 6 months and 255(95%) of the respondents agreed to it that they share their ITN with somebody.

Table 1. Sociodemographic characteristics of the respondents

Variables	Frequency n(307)	Percentage (%)
Age (In years)		
20-30	54	17.6
31-40	56	39.4
41-50	181	58.9
51-60	16	5.2
Gender		
Female	183	59.6
Male	124	40.4
Marital Status		
Divorced	24	7.8
Married	218	71.0
Single	65	21.2
Level of Education		
Tertiary	10	3.3
S.H.S	73	23.8
None	92	30.0
J.H.S	132	43.0
Occupation		
Unemployed	7	2.3
Employ	300	97.7
Monthly income (GH¢)		
1000-2000	11	3.6
500-1000	16	5.2
200-500	58	18.9
Less than 200	222	72.3
Occupants per room		
One room	6	2.0
Two Room	31	10.1
Three Room	120	39.1
Four Room	125	40.7
More than Four rooms	25	8.1

Source: Field Data, 2022

Table 2. Usage of Insecticide Treated Net among Residents

Variables	Frequency	Percent (%)
Do you use the ITN		
Yes	269	87.6
No	38	12.3
If Yes, how often		
Always	76	28
Sometimes	193	72
Duration for using your ITN		
1-3yrs	10	4
6-12months	41	15
Less than 6months	218	81
Do you share your net with someone?		
Yes	255	95
No	14	5
If Yes, how many		
1	162	60
2	91	35.6
3	14	5
4	2	0.7

Source: Field Data, 2022

3.3 Factors That Affect the Use of ITN

3.3.1 Availability of insecticide treated nets

Table 3 presents the availability of ITN among the households in the municipality. Hundred per cent of the households had ITNs. More than half of the respondents 205 (66.8%) had 1-2 ITNs. Majority of individuals in the household 269 (87.6%) reported owning Insecticide Treated Net (ITN). About 213 (69.3%) participants claimed they obtained their ITNs from hospital/ clinic. Also, majority of the participants 220 (82%) indicated they had the square type of ITN while 49 (16%) had the conical type.

3.3.2 Knowledge on ITN

Knowledge of respondents on ITN in malaria prevention is summarized in Table 4. Majority 290 (94.4%) of the respondents thought ITN could be used to prevent malaria. Most of the respondent 213 (69.4) said ITN was used to help reduce the burden of malaria on them. Most of the respondents 260 (97.0%) retreated their ITNs after using for a while. More than half of the respondents 220 (82%) had their information from health workers.

3.3.3 Environmental factors that may influence the use of ITN

Table 5 summarizes the environmental factors that may influence the use of ITN. Most of the

respondents 220 (71.6%) claimed that the weather did not permit the use of the ITN. Conversely, more than half of the respondents 205 (66.7%) of the respondents said the structure of the room permitted the use of ITN. Also, almost half of the respondents 151 (49%) indicated that they felt hot under ITNs. Majority of the respondents 201 (65.5%) said education on ITN increased its use.

3.3.4 Other factors that may influence the use of ITN

Table 6 shows some other factors that influenced the use of ITN by the respondents. Most of the respondents 201 (66.4%) of the respondent strongly disagree that they use ITN because their neighbors use it and expected them to do same. An overwhelming majority 209 (95.4%) of the respondents indicated they would use ITN because it promotes health. Similarly, 282 (91.9%) of the study participants agreed that they would use ITN if there were by-laws requiring that it must be used by everyone in the district. Again, most 293 (95.4%) of the respondents strongly agreed that they would use ITN if it was recommended by a doctor. Again, more than half of the respondents 197 (64.2%) agreed to use ITN if only it would prevent malaria. Finally, majority 297 (96.7%) of the respondent strongly agreed that they would use ITN if it makes their sleep comfortable.

Table 3. Availability of insecticide treated net

Variables	Frequency	Percent (%)
Does your household have ITN		
Yes	307	100
No	0	0
If yes how many		
1-2	205	66.8
3-4	89	28.9
5+	13	4.3
Do you own ITN		
Yes	269	87.6
No	38	12.4
Where did you obtain your net		
Distribution at home	56	21
Hospital/Clinic	213	79
Type of ITN		
Square	220	82
Conical	49	18

Source: Field Data, 2022

Table 4. Knowledge ITN

Variable	Frequency	Percent (%)
Do you think ITN use can prevent malaria?		
Yes	290	94.4
No	17	5.5
Advantages of ITN use		
Helps save money for other purposes	92	30
Reduce the burden of malaria on them	213	69.4
Saves time from visiting the hospital	2	0.6
Do you retreat your ITN after using for a while		
Yes	9	3.0
No	260	97.0
Sources of information for the ITN		
Health workers	220	82
Friends	49	18

Source: Field Data, 2020

Table 5. Environmental factors that influence the use of ITN

Variables	Frequency	Percent (%)
The weather permits the use of the ITN		
Yes	87	38.3
No	220	71.6
The structure of the room permits you to use ITN		
Yes	205	66.7
No	102	33.2
Reason that might prevent you from sleeping under ITN		
Causes rashes	56	18
Causes heat	151	49
Creates inconvenienced sleep	100	32
What increases the use of ITN		
Education on ITN use	201	65.5
Free distribution	99	32.2
Purchase of ITN	7	2.3

Source: Field Data, 2022

Table 6. Other factors that may influence the use of ITN

Variables	Frequency	Percent (%)
I will use ITN because my neighbors use it		
Strongly Disagree	201	66.4
Disagree	101	32.9
Agree	2	0.7
Strongly Agree	3	0.0
I will use ITN it promotes health		
Strongly Disagree	3	1.0
Disagree	4	1.3
Neutral	1	0.3
Agree	293	95.4
Strongly Agree	6	2.0
I will use ITN if there are by-laws requiring its use		
Strongly Disagree	3	1.0
Disagree	10	3.3
Agree	282	91.9
Strongly Agree	12	3.9
Will use ITN if it is recommended to me by a Doctor		
Strongly Disagree	0	0
Disagree	3	1.0
Agree	293	95.4
Strongly Agree	11	3.6
Will use ITN if it protects me from getting malaria		
Strongly Disagree	1	0.3
Agree	197	64.2
Strongly Agree	109	35.5
I will use ITN if it makes me sleep comfortably		
Strongly Disagree	1	0.3
Disagree	4	1.3
Agree	297	96.7
Strongly Agree	5	1.6

Source: Field Data, 2022

Table 7. Relationship between demographic characteristics, knowledge and some factors that influence the use of ITN

Variables	ITN USE			Odds Ratio (95%CI)	P- value
	Total f (%)	Yes f (%)	No f (%)		
Age (In years)					
20-30	54(17.6)	48(15.6)	6(2)	1.633(0.43-1.44)	0.948
31-40	121(39.6)	119(39)	2(0.7)	0.824(0.34-1.55)	
41-50	116(37.8)	94(30.6)	22(7.2)	0.230(0.25-1.35)	
51-60	16(5.2)	8(2.6)	8(2.6)	0.910(0.5-1.32)	
Gender					
Female	183(59.6)	175(57)	8(2.6)	0.334(0.33-1.46)	0.288
Male	124(40.4)	94(30.6)	30(9.8)	0.334(0.61-1.48)	
Marital Status					
Single	65(21.2)	35(11.4)	30(9.8)	0.230(0.25-1.35)	0.594
Married	218(71)	216(70)	2(0.6)	0.435(0.54-1.56)	
Divorce	24(7.8)	18(5.9)	6(1.9)	0.624(0.24-1.53)	
Level of Education					
S.H.S	73(23)	67(21)	6(2)	0.853(0.52-1.82)	0.028
J.H.S	132(43)	110(35.8)	22(7.2)	0.734(0.21-1.46)	
Tertiary	92(30)	90(29.3)	2(0.7)	2.036(1.7-5.32)	
None	10(3.3)	2(0.7)	8(2.6)	0.21(0.04-1.12)	

Variables	ITN USE			Odds Ratio (95%CI)	P- value
	Total f (%)	Yes f (%)	No f (%)		
Occupation					
Farmer	208(68)	200(65)	8(3)	0.75(0.19-3.00)	0.617
Government Employee	17(5.5)	17(5.5)	0(0)	1.65(0.94-2.90)	
Private Company Employee	10(3.3)	10(3.3)	0(0)	1.70(0.97-2.97)	
Unemployed	7(2.3)	0(0)	7(2.3)	0.21(0.04-1.12)	
Monthly income					
1000-2000	11(3.6)	8(2.6)	3(1)	0.67(0.32-1.4)	0.524
500-1000	16(5.2)	16(5.2)	0(0)	1.66(0.94-2.93)	
200-500	58(28)	55(18)	3(1)	0.75(0.19-3.00)	
Less than 200	222(72.3)	190(61.9)	32(10.4)	1.65(0.94-2.90)	
No. of rooms occupants					
One room	6(2)	3(1)	3(1)	1.70(.97-2.97)	0.021
Two rooms	31(10.1)	28(9.1)	3(1)	1.64(0.57-4.72)	
Three rooms	120(39.1)	118(38.4)	2(0.7)	0.41(.73,2.74)	
Four rooms	125(40.7)	112(36.5)	13(4.2)	0.41(0.21-0.79)	
More than four rooms	25(8.1)	8(2.6)	17(5.5)	0.73(0.44-1.44)	

Source: Field Data, 2022

3.3.5 Relationship between demographic characteristics that influence the use of ITN

Table 7 depicts logistic regression analysis of independence conducted to establish a relationship between respondents' demographic characteristics that influenced the use of ITN. All the demographic features assessed including age, gender, marital status, level of education etc had no statistical significance with the use insecticide treated bed nets with various p-values more 0.06. However, respondents within age range 20-30 had higher odds of using ITN 1.633(CI=0.43-1.44) than other groups. Also, respondents with tertiary educational level had 2.036 OR of using ITN.

4. DISCUSSION

4.1 Availability of Insecticide Treated Net

Insecticide Treated Nets are distributed by a variety of organisations, including federal departments, non-governmental organizations, and other entities. This is done to prevent the transmission of malaria among the community's residents. According to the present study, it was recorded that 269 of 307 had ITN. From the percentage, more than half of the participants owned the net, which means ITN was available to the people. The study revealed that (66.8%) were in the possession of, at least, one or two ITNs, which indicated the availability of ITNs. This study is similar to the study by [35], where a survey was conducted in rural Mozambique to ascertain the availability of long lasting treated

net (LLTNS) had the majority with ITN. The survey was undertaken in thirty villages with 450 households involved. The study showed that 62.5% were in possession of, at least, one LLITN. The study goes ahead to show that most of the nets owned by the people were obtained through a mass distribution campaign in 2018 at antenatal care unit. The similarity in the results could be due to the fact that governments in Africa and outside Africa put premium on malaria prevention and control.

In 2017, DHMT distributed 18,351 ITNs to the residents of Berekum in order to reduce the number of malaria cases in the Municipality. In 2019, health facilities were given 7,250 ITNs to distribute to all patients who visited the hospital (2019, BHD). This was undertaken in order to prevent malaria in pregnant women, children under the age of five, and a large number of malaria morbidities in the Municipality. In other to achieve SDG 1 and 3, which are reducing poverty and good health and wellbeing, combating disease like malaria and other vector borne diseases, ITN should be available to all people. This can be done through mass distribution of ITN at the various houses. According to [30], attempts to expand ITN penetration in order to reach universal coverage have failed to fulfill their goals.

4.2 Usage of ITN

Overall the majority of the people used ITN giving higher prevalence rate of ITN usage in the municipality. The results revealed that ITN

ownership and the use in the Municipality high among respondents who participated in the study. There were 87.6% of participants who owned ITN which shows that majority of the participants knew the benefits of using ITN. This means most of the people had an idea about the use and the importance of ITN. The analysis also revealed that most of those who owned the ITNs used it and this implied that people were aware of the value and benefits of ITN. This is quite significant because only few people did not own ITN and this could be due to negative perception or non-availability of the ITN. On the usage of ITN, there were 193(72%) respondents who said they sometimes used it and 76(28%) said they always or consistently used ITN. There are others who mentioned that they would use the nets if recommended to them by a doctor. This shows the kind of perception they have towards the use of the ITNs. Moreover, there were other reasons which might prevent the people from using the Nets constantly, for example the weather condition and the number of the people sleeping in the room.

This is similar to a study done by [28], where respondents indicated that they used ITN throughout the night during the season of the mosquitos. Despite 70.3% of the respondents owned ITNs, only 34.4 % used their Nets consistently. This means more than half of the participants did not sleep under ITN always. This means most people believe that it is only the raining seasons which mosquitos breed a lot and it is only this period that they feel sleeping under ITN is important. The use of ITN by those at risk of malaria is one of the key malaria vector management strategies, according to Lefevre et al [24]. Because of their efficacy in preventing mosquito bites, the World Health Organization advises the use of ITNs by people at risk of malaria in areas where mosquitos breed more [25]. This means WHO recommend ITN as the effective protective method that can help in prevention of malaria.

4.3 Factors that Influence the Use of ITN

Most of the respondents of the respondent strongly disagree that they use ITN because their neighbors use it and expected them to do same. An overwhelming majority of the respondents indicated they would use ITN because it promotes health. Similarly, most of the study participants agreed that they would use ITN if there were by-laws requiring that it must be used by everyone in the district. Again, most of the respondents strongly agreed that they would use

ITN if it was recommended by a doctor. Again, more than half of the respondents agreed to use ITN if only it would prevent malaria. Finally, majority of the respondent strongly agreed that they would use ITN if it makes their sleep comfortable. One of the most important factors in raising ITN use to combat malaria has been health education and recommendations from other people. The media, especially television and radio, as well as the use of mobile community information vans and health workers, were established as the primary sources of information in assisting people in the community in preventing malaria [22]. The lack of ITNs has been identified as a limiting factor in the use of insecticide-treated nets in many reports. Non-ownership of ITNs was cited as the second most common explanation for caregivers not using ITNs for children under the age of five years in a report [19].

In some areas the weather could be a discouragement to the appropriate use of ITN due to its hotness. The structures in some of our localities, mostly our villages, do not match up to the urban areas. They have small spaces and are usually crowded at night. In dry seasons when the weather is a little hot, people may wish to sleep outside the room, which becomes difficult to use the ITN. Most of the structures in the study areas were found to be small; a reason to deter the people from using ITN. Again, most of the people were found sleeping on the floor at night. The study found out that most of the participant's rooms and building structure were predictors of the utilization of the ITN. There was no enough space to hang or use their net. The housing structure, arrangement of the room and space available did not allow them to use ITN.

These findings support a study by [2] which reports that during the rainy season, the majority of pregnant women sleep under an ITN. When the weather is hot or $>30^{\circ}$ Celsius, many of them fail to sleep under the net. It was discovered that some of the homes have very small windows, resulting in poor ventilation. Interactions with health workers revealed that most women are unable to hang the net therefore it was entrusted to health workers to hang it in the homes of pregnant women. Due to a lack of medical personnel, this procedure was placed on hold. Physical geography and local behavioural habits are all environmental factors that contribute to malaria vulnerability [11]. Temperature affects the life cycle of malaria parasites; a temperature-rise of 21° to 27° Celsius is optimal for the parasite to complete its life cycle in fewer than

ten days [9]. Since there are no runoffs, a high field water level is a good breeding site and it allows for the formation of stagnant water pods [7].

4.4 Association between Sociodemographic Characteristics and ITN Use

In this study none of demographic characteristics was statistically significant. This finding is in sharp contrast with Gueye et al. [23] study to determine the factors that influence usage of ITNs among pregnant women. The findings of the study revealed that age, income and family size were significantly associated with the utilization of insecticide treated net. This implies that the level of income of family can determine if ITN can be used all the time. Thus when ITNs are not distributed freely, and the family is not financially sound, it cannot afford another one from the market. The level of education of a person normally determines how that person understands and perceives certain issues. This might be that they knew the consequence of malaria and what it can lead up to so they try to protect themselves from getting it by using ITNs. On the other hand, those with tertiary education were the second group of people who used ITN [21]. These are the people who know much and do not need further education before they protect themselves from getting malaria. They learnt a lot and knew the recommended method which will help to protect them from getting malaria than a person who did not have formal education. A cross tabulation of ITN usage was done against level of education and usage of ITN. This implies that there is a strong association between ITNs use and level of education according to other studies. Those who are educated and know the importance of using ITN sometimes involve themselves in its usage. They sleep in it in order to avoid themselves from getting malaria. Those with education understand certain issues and moreover, knew the consequence of malaria when care is not being taken. A study by Choi et. al. [9] has shown that higher educational attainment has substantial impact on the use of ITN. This means those who have education have simple understanding when it comes to their health. They know what is best for them and the kind of measures when put in place will protect from sickness.

5. LIMITATIONS OF THE STUDY

The major limitations of this study included the following; some of homes that were visited, some respondents did not allow the researchers to

enter their sleeping places to observe if they actually had the ITNs and whether they were hung or not. Some people were unwilling to take part in the study and other participants were busy about their daily activities and business even though they consented to participate with survey.

6. CONCLUSIONS

Despite the fact that ITN is owned by the people, few of them use it regularly or often with various excuses like hot weather, skin rashes discomfort etc. The study concludes that if the Nets are distributed continuously with words of proper education from the health workers, the use of the Nets would be improved in the Berekum East Municipality. Also, knowledge on ITN was good however usage was poor.

7. RECOMMENDATIONS

- i. The Ministry of Health should seek for assistance and funding from NGOs and government to enable a free mass distribution of ITNs to increase access in the communities.
- ii. Health workers should improve upon public education programmes in the communities so that the people will know more about the importance of ITN usage.
- iii. Stakeholders should lobby for further reduction or waiver of taxes on mosquito nets to enable people in the low socio-economic status purchase them for use.
- iv. Further study should be conducted involving all the stakeholders for malaria prevention to unearth the other factors that influence the use of ITNs.

CONSENT AND ETHICAL APPROVAL

Ethical approval was given by the Ghana Health Service Ethics Review Committee, Research and Development Division (approval number: GHS-ERC 031/12/20) on 26th March, 2021 as part of the researchers requirement to conduct the study. Written consents were obtained from all participants in this study. During the data collection, the names of the respondents were not written but codes were assigned to ensure anonymity. The respondents were assured that the information collected would be kept confidential and used only for the purpose of the study. The respondents were made to acknowledge the purpose and contents of the study and all questions satisfactorily explained to

them in a language understood by them (English or Twi). They fully understood the contents and any potential implication as well as the right to change their minds (i.e. withdraw from the research) even after they had signed the consent form.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Admasie A, Zemba A, Paulos W. Insecticide-Treated nets utilization and associated factors among under-5 Years Old children in Mirab-abaya District, Gamo-gofa Zone, Ethiopia. *Frontiers in Public Health*. 2018;6-7.
2. Aberese-Akoto. Health system, socio-cultural, economic, environmental and individual factors influencing bed net use in the Prevention of Malaria in Pregnancy in Two Regions in Ghana. 2019;1-9.
3. Ahorlu, Bart-Plange C. Understanding the gap between access and the use: a qualitative study on barriers and facilitators to ITN use in Ghana. *Malaria Journal*. 2019;9-13.
4. Asenso-Okyere K, Ankoma, Asante F. Economic Burden of Malaria in Ghana. In: Institute of Statistical, Social and Economic Research (ISSER), University of Ghana. 2018;115-117.
5. Atenchong N, Ozim, J. Attitudes toward Utilization of Insecticide-Treated Bed Nets among Pregnant Women and Care-Takers of Under-Five. *Infection Control. Tips*. 2020;445-458.
6. Awine T, Malm K, Bart-Plange C, Silal SP. Towards malaria control and elimination in Ghana: Challenges and decision-making tools to guide planning. *Global Health Action*. 2021;10(1):1381471-1381471.
7. Baffour-Awuah DF. Insecticide resistance in malaria vectors in Kumasi, Ghana. *Parasites Vectors*. 2019;9(1):633.
8. BMA. Berekum Municipal Assembly, 2015-2020 Medium-Term Development Plan. Brong Ahafo Region, Ghana. 2020;4-9.
9. Choi L, Pryce J, Richardson M, Lutje V, Walshe D, Garner P. Guidelines for malaria vector control. World Health Organization. 2019;1-171.
10. Choonara S, Odimegwu CO, Elwange BC. Factors influencing the usage of different types of malaria prevention methods during pregnancy in Kenya. *African Health Sciences*. 2021;21(2):413- 419.
11. Chukwuocha UM. Perceptions on the use of insecticide treated nets in parts of the Imo River Basin, Nigeria: Implications for preventing malaria in pregnancy. *African Journal of Reproductive Health*. 2018; 14(1).
12. Day JF. Mosquito Oviposition Behavior and Vector Control. *Insects*. 2021;7(4): 65.
DOI:10.3390/insects7040065
13. De Silva PM, Marshall JM. Factors contributing to urban malaria transmission in Sub-Saharan Africa: A systematic review. *Journal of Tropical Medicine*. 2019;187-192.
14. Divya G, Meenakshi SM, Rajkumar R. Association between rainfall and malaria outbreak in Madurai. *J. Soc. Sci*. 2018; 4(18):1-3.
15. Etikan I, Musa SA, Alkassim RS. Comparison of convenience sampling and purposive sampling. *American Journal of Theoretical Applied Statistics*. 2020;5(1): 1-4.
16. De Silva PM, Marshall JM. Factors contributing to urban malaria transmission in sub-Saharan Africa: a systematic review. *Journal of Tropical Medicine*. 2018; 233-245.
17. Finda MF, Moshi IR, Monroe A, Limwagu AJ, Nyoni AP, Swai JK et al. Linking human behaviours and malaria vector biting risk in south-eastern Tanzania. *PloS one*. 2021; 14(6):0217414.
18. Fischer S, Schweigmann N. Seasonal occurrence of immature mosquitoes in swimming pools in Buenos Aires, Argentina. *Journal of the American Mosquito Control Association*. 2019;26: 95-98.
DOI:10.2987/09-5932.1
19. Fournet F, Cussac M, Ouari A, Meyer PE, Toé HK, Gouagna LC. Diversity in anopheline larval habitats and adult composition during the dry and wet seasons in Ouagadougou (Burkina Faso). *Malaria Journal*. 2019;9(1):78.
20. Fullman, Bart-Plange C. The effectiveness of insecticide-treated nets and indoor residual spraying in reducing malaria morbidity and child mortality in sub-Saharan Africa. *Malar J*. 2020;12:62.
DOI:10.1186/1475-2875-12-62

21. Ghana Statistical Service. 2021 Population and Housing Census Report: Ghana Statistical Service. 2021;45-47.
22. Githinji EK. Impact of Insecticide Resistance on *P. falciparum* Vectors' Biting, Feeding, and Resting Behaviour in Selected Clusters in Teso North and South Subcounties in Busia County, Western Kenya. Journal of Parasitology Research. 2020;9423682. DOI:10.1155/2020/9423682
23. Gueye CS, Newby G, Gosling RD, Whittaker MA, Chandramohan D, Slutsker L, et al. Strategies and approaches to vector control in nine malaria-eliminating countries: a cross-case study analysis. Malaria Journal. 2018;15(1):2.
24. Lefevre T, Ohm J, Dabiré KR, Cohuet A, Choisy M, Thomas MB, et al. Transmission traits of malaria parasites within the mosquito: Genetic variation, phenotypic plasticity, and consequences for control. Evolutionary Applications. 2018;11(4): 456-469.
25. Lengeler C, Snow RW. From efficacy to effectiveness: insecticide treated bed nets in Africa. Bull World Health Organ. 2020; 74(3):325–332. PMID: PMC2486924 PMID: 8789931.
26. Matthys B, Koudou B, N'Goran E, Vounatsou P, Gosoni L, Koné M, et al. Spatial dispersion and characterization of mosquito breeding habitats in urban vegetable-production areas of Abidjan, Côte d'Ivoire. Annals of Tropical Medicine Parasitology. 2010;104(8):649-666.
27. Mo FA. Berekum Municipal. Ministry of Food and Agriculture. 2020;456-459.
28. Muhumuza E, Namuhani N, Balugaba BE, Namata J, Kiracho EE. Factors associated with use of malaria control interventions by pregnant women in Buwunga subcounty, Bugiri District. Malaria Journal. 2016;15(1): 342.
29. Njumkeng C, Apinjoh TO, Anchang-Kimbi JK, Amin ET, Tanue EA, Njua-Yafi C, et al. Coverage and usage of insecticide treated nets (ITNs) within households: Associated factors and effect on the prevalence of malaria parasitaemia in the Mount Cameroon area. BMC Public Health. 2019; 19(1):1216. DOI:10.1186/s12889-019-7555-x
30. Nkegbe PK, Kuunibe N, Sekyi S. Poverty and malaria morbidity in the Jirapa District of Ghana: A count regression approach. Cogent Economics and Finance. 2018; 5(1).
31. Nyavor KD, Kweku M, Agbemafle I, Takramah W, Norman I, Tarkang E. Assessing the ownership, usage and knowledge of Insecticide Treated Nets (ITNs) in Malaria Prevention in the Hohoe Municipality, Ghana. The Pan African Medical Journal. 2020;28:67-67. DOI:10.11604/pamj.2017.28.67.9934
32. United Nation Children's Fund. Malaria and Children: Progress in intervention Coverage. 2019;213-233.
33. UNICEF. World Malaria Day. USA United Nations Children's Fund. 2019;23-29.
34. WHO. World Malaria Report. World Health Organization. 2018;45-51.
35. WHO. World Malaria Geneva Report. Geneva World Health Organization. 2020; 78-84.
36. Sakeah E, Doctor HV, McCloskey L, Bernstein J, Yeboah-Antwi K, Mills S. Using the community-based health planning and services program to promote skilled delivery in rural Ghana: socio-demographic factors that influence women utilization of skilled attendants at birth in Northern Ghana. BMC public health. 2014;14(1):1-9.
37. Sakeah E, McCloskey L, Bernstein J, Yeboah-Antwi K, Mills S, Doctor HV. Can community health officer-midwives effectively integrate skilled birth attendance in the community-based health planning and services program in rural Ghana?. Reproductive Health. 2014;11(1): 1-3.

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