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Research Article

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A Survey of Ownership and Utilization of Insecticide Treated Nets (ITNs) among Pregnant Women Attending Anc Clinic

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Abstract

This study sought to assess the ownership and utilization of insecticide treated nets among pregnant women attending antenatal care clinic A cross-sectional study design was adopted to conduct the study METHODS: A structured questionnaire was used to collect data from 185 pregnant women. The data were presented by means of descriptive statistics. Findings showed that 93.5% of the pregnant women owned at least an ITN with 90.3% owning more than one ITN prior to the survey. However, 6.0% of the pregnant women slept under ITN the night before the survey. A combination of personal, household, and institutional factors accounted for the poor usage of the ITNs

1. Introduction

Malaria infection during pregnancy is a major public health problem in Ghana, with substantial risks for the mother, her foetus, and the neonate. The primary strategy for preventing and reducing malaria transmission among pregnant women is vector control. Therefore, insecticide treated nets are freely distributed to every pregnant woman at antenatal clinics in Ghana. Despite these gains, a large gap exists between insecticide treated net ownership and usage among pregnant women.

2. Background

Malaria continuous to be a major public health problem across the globe although preventable and curable [9]. Malaria infection during pregnancy is a major public health problem in Ghana, with substantial risks for the mother, her foetus, and the neonate [11]. In 2018, there were an estimated 228 million cases of malaria worldwide. The burden of malaria is particularly heavy in the WHO's (World Health Organization) African Region. In 2018, 94 percent of malaria fatalities and 93 percent of cases occurred in this area. In the same period, about half of the world's population was at risk for malaria, with sub-Saharan Africa accounting for the majority of cases and fatalities [39].

In order to achieve Sustainable Development Goal 3 (SDG3) and Millennium Development Goal 6 (MDG6) objective 8, which aims to stop and reverse the incidence of malaria and other serious illnesses, effective malaria control among pregnant women is essential [38]. According to a physical barrier as well as an insecticidal effect for pregnant women are provided by sleeping under an insecticide-treated net (ITN), which can decrease interaction between people and mosquitoes [40]. Where there is widespread access to and use of these nets within a community, there can be population-wide protection as a result of the large-scale death of mosquitoes. Approximately 50% of all Africans at risk for malaria were covered with an insecticide-treated net in 2018, up from 29% in 2010.

Numerous studies have been done on the efficiency of insecticide-treated nets in preventing malaria in expectant women around the world [17,30,33-41]. As a result, the WHO has started producing

and distributing ITNs to all nations with an active malaria epidemic. In 2017 and 2018 about 448 million nets were reported as having been shipped globally. In addition, routine distributions through vaccination programs in ANC facilities continue to play a crucial role, public campaigns were the primary mode of delivery globally. ITNs are crucial for the management and prevention of malaria in pregnant women. In some parts of Africa where malaria is the leading cause of death for children under five, ITNs have also been shown to significantly lower overall child mortality by at least 20%. ITNs have also been found to be highly effective in protecting pregnant women sleeping under them and their unborn babies [29-31].

ITNs are very beneficial in Ghana when used appropriately and regularly in lowering malaria morbidity and death among pregnant women, according to [2, 10,18, 23-26]. However, the use of ITNs is lower than the WHO goal level of 80%. For instance, only 43% of Ghanaian houses with at least one ITN had members who slept under one at night in 2019. In households with at least one ITN, however, 54% of the population did so. Overall, 49% of expectant women aged 15 to 49 slept under an ITN the night before the poll, and 58% of expectant women residing in households with at least one ITN did as well [13]. Pregnant women's usage of ITNs may be determined by a number of factors including pregnant women's poor educational attainment and low family wealth [6-28]. found that homes with fewer nets and those with larger families or households with bad sleeping arrangements used ITN less frequently [3].

Available data indicate that 45.5% of all hospital cases in the Bawku Presbyterian hospital for the year 2020 was due to malaria and 43.5% of all cases in 2021 was also attributed to malaria [5]. Interestingly, malaria in pregnancy cases accounted for 15% of all malaria cases in the hospital [5]. However, with the plethora of published articles accessed, no published articles were found on the topic in the Bawku Presbyterian hospital. This study therefore aims to assess the ownership and utilisation of ITNs among pregnant women attending ANC in the Bawku Presbyterian Hospital in order to add to recommended strategies aimed at improving the use of ITNs among pregnant women in Ghana.

3. Methods

3.1 Study Design and Study Setting

A descriptive cross-sectional survey design was used in this study. The design was chosen because the researchers were able to gather data at one point in time through the cross-sectional study design [27]. The cross-sectional study design gave the researcher the opportunity to employ quantitative data analysis techniques in describing occurrences and to make sense of the connections between the data and the contributing variables. The study was conducted in the Presbyterian Hospital in Bawku. The Bawku Presbyterian Hospital caters for population that is primarily agricultural (about 119, 458 people). It is the referral hospital in the municipality, and because it is near to the border, it partially serves locals as well as patients from the north-eastern region of Ghana, southern Burkina Faso, and northern Togo. There are eleven departments in the Hospital, including the outpatient department (OPD), emergency room, obstetrics and gynaecology, theatre, ophthalmology, and public health. On weekdays, the hospital provides ANC services to expectant women. ITNs are provided to expectant mothers who register for ANC for the first time, among other services provided at the ANC (registrants).

3.2 Population, Sampling Technique and Sample Size

All pregnant women of the ANC clinic at the Bawku Presbyterian hospital were thus included in the study population. The ANC clinic had an average of 344 ANC attendants as of June 2022. The study employed the convenience sampling method to select a representative sample from the target population. This enabled the researchers to select the most readily available persons as respondents of the study [27]. Specifically, the researcher contacted the pregnant women individually at the ANC clinic to explain the study to them. Those who met the inclusion criteria and agreed to participate in the study were contacted again a week later to respond to the questionnaire. The sample size for the study was determined by using Slovin's sampling formula: $n = N/ [1+N (e)^2]$ where…n = sample size, N = population size, and e = margin of error (Tejada & Punzalan, 2011). Therefore, for the stated average population of 344, a sample size of 185 was used for the study given a 95% confidence level and a margin of error of 5%. However, an upward adjustment of 2% was made to cater for potential dropouts. This brought the total number of respondents to 189.

3.3 Data Collection Tool and Procedure

The study's data collection tool was a structured self-administered questionnaire. The design of the questionnaire made it simple for the respondents to grasp and comprised of four sections (A–D) made up of thirty questions. Section A comprised of six question on the socio-demographic characteristics of respondents, section B included four questions on the ownership of ITNs, section C also included five questions on the utilisation of ITNs, and section D contained fifteen questions on the factors that influence the utilisation of ITNs. The data collection process lasted one month. A participant information leaflet containing in-depth information on the study processes was given to each respondent. For respondents who were unable to comprehend the English language, the researchers translated the questions into their preferred local languages before the questionnaires were administered. All the pregnant women voluntarily signed an informed consent form before data collection commenced. Respondents who were unable to sign were made to thumbprint. In all, about 15 to 20 minutes was spent per respondent during the data collection process.

3.4 Analysis

The completed questionnaires were verified and audited to avoid errors. The primary data collected with the questionnaire were entered into the Statistical Package for Social Sciences (SPSS) version 16. This was followed by the statistical analysis in tandem with the objectives of the study. Values for each questionnaire entered into the SPSS software were first checked for errors, missing data and plausibility. Frequencies and percentages were

then calculated and tabulated according to the category of variables with the aim of describing the data.

3.5 Ethics

To ensure that the human subjects of the study were protected and respected, the following steps were taken. To get institutional consent and permission to perform the study in the hospital, a cover letter was addressed to the medical superintendent of the hospital. Each respondent was given and explained the participant information pamphlet, which comprised the study's purpose, procedures, risks, and benefits. Each respondent signed or thumb printed informed consent papers to give their written consent. Personal identifiers, such as the names of respondents, were not written on the questionnaires for reasons of anonymity and confidentiality [36]. The freedom to voluntarily resign from the study at any time without consequences was also made clear to participants. All methods were performed in accordance with the relevant guidelines and regulations. This study received approval from the Institutional Review Board (IRB) of the Kwame Nkrumah University of Science and Technology (KNUST) and the various Health Training Institutions used for this study

4. Results

4.1 Demographic Characteristics of Respondents

This part presents the preliminary data which consists of the background data of the respondents for the study.

Characteristics	Frequency (N)	Percentage (%)
Age in years		
18 – 20 years	11	5.9
21 – 30 years	129	69.7
31 – 40 years	43	23.2
41 – 50 years	2	1.1
Total	185	100%
Religion		
Christianity	67	36.2
Islam	104	56.2
African tradition	14	7.6
Others	0	0.0
Total	185	100%
Marital status		
Single	18	9.7
Married	144	77.8
Cohabiting	23	12.4
Total	185	100%
Highest educational level		
No education	20	10.8
Basic school	46	24.9
Secondary	85	45.9
Tertiary	34	18.4
Total	185	100%
Occupation		
Unemployed	16	8.6
Farming	22	11.9
Trading	113	61.1
Public servant	34	18.4
Total	185	100%
Age of pregnancy		
1st trimester	41	22.2
2nd Trimester	98	53.0

3rd Trimester	46	24.9
Total	185	100%

Source: *Administered questionnaire (2022)*

Table 1: Socio-Demographic characteristics of participants

From Table 1. most respondents 129 (69.7%) were between 21-30 years, 43 (23.2%) were between 31-40 years, 11 (5.9%) were between 18-20 years, and 2 (1.1%) were between 41-50 years. With reference to religion, most respondents were Muslims 104 (56.2%), 67 (36.2%) were Christians, and 14 (7.6%) were of the African traditional religion. Regarding marital status, 144 (77.8%) were married, 23 (12.4%) were cohabitating, and 18 (9.7%) were single. With regards to education, 85 (45.9%) of respondents had secondary education, 46 (24.9%) had basic education, 34 (18.4%) had tertiary education, and 20 (10.8%) had no education. Regarding occupation, 113 (61.1%) of the respondents were traders, 34 (18.4%) were public servants, 22 (11.9%) were farmers, and 16 (8.6%) were unemployed. With reference to age of pregnancy, 98 (53.0%) of respondents were in their 2nd trimester of pregnancy, 46 (24.9%) were in 3rd trimester, and 41 (22.2%) were in their 1st trimester.

4.2 Ownership of ITNS among Pregnant Women

This presents participants response to the ownership of ITNs

Personal factors	Responses	Frequency (N)	Percentage (%)
I have heard of ITN before.	Strongly Disagree	3	1.6
	Disagree	5	2.7
	Agree	58	31.4
	Strongly Agree	119	64.3
I own an ITN.	Strongly Disagree	1	0.5
	Disagree	11	5.9
	Agree	71	38.4
	Strongly Agree	102	55.1
I own more than 1 ITN.	Strongly Disagree	2	1.1
	Disagree	16	8.6
	Agree	63	34.1
	Strongly Agree	104	56.2
I owned an ITN before my current pregnancy.	Strongly Disagree	7	3.8
	Disagree	13	7.0
	Agree	74	40.0
	Strongly Agree	91	49.2

Source: *Administered questionnaire (2022)*

Table 2: Ownership of ITNs among Pregnant Women

The data presented in Table 2 details participants response with regards to ownership of ITNs. A slight majority, 119 (64.3%) of the respondents strongly agreed that they have heard of ITNs before, 58 (31.4%) agreed, 5 (2.7%) disagreed, and 3 (1.6%) strongly disagreed. Also, 102 (55.1%) strongly agreed that they owned an ITN, 71 (38.4%) agreed, 11 (5.9%) disagreed, and 1 (0.5%) strongly disagreed. Again, 104 (56.2) of the participants strongly agreed that they owned more than 1 ITN, 63 (34.1%) agreed, 16 (8.6%) disagreed, and 2 (1.1%) strongly disagreed. Finally, 91 (49.2%) of the respondents strongly agreed that they owned an ITN before their current pregnancies, 74 (40.0%) agreed, 13 (7.0%) disagreed, and 7 (3.8%) strongly disagreed.

4.3 Utilisation of ITNs among Pregnant Women

Personal factors	Responses	Frequency (N)	Percentage (%)
I slept under an ITN last night.	Strongly Disagree	108	58.4
	Disagree	66	35.7
	Agree	9	4.9
	Strongly Agree	2	1.1
I continuously sleep under an ITN throughout the year.	Strongly Disagree	121	65.4
	Disagree	49	26.5
	Agree	8	4.3
	Strongly Agree	7	3.8
I sleep under an ITN only in the rainy season.	Strongly Disagree	5	2.7
	Disagree	16	8.6
	Agree	73	39.5
	Strongly Agree	91	49.2
I sleep under an ITN only during pregnancy.	Strongly Disagree	96	51.9
	Disagree	64	34.6
	Agree	16	8.6
	Strongly Agree	9	4.9
My other children sleep under the ITN.	Strongly Disagree	107	57.8
	Disagree	64	34.6
	Agree	8	4.3
	Strongly Agree	6	3.2

Source: *Administered questionnaire (2022)*

Table 3: Utilization of ITNs among Pregnant Women

From Table 3, the study revealed that majority of respondents 108 (58.4%) strongly disagreed that they slept under an ITN the night before the survey, 66 (35.7%) disagreed, 9 (4.9%) agreed, and 2 (1.1%) strongly agreed. Also, 121 (65.4%) of the respondents strongly agreed that they continuously slept under the ITN throughout the year, 49 (26.5%) disagreed, 8 (4.3%) agreed, and 7 (3.8%) strongly agreed. Again, 91 (49.2%) of the respondents strongly agreed that they slept under the ITN only in the rainy season, 73 (39.5%) agreed, 16 (8.6%) disagreed, and 5 (2.7%) strongly agreed. Yet again, 96 (51.9%) of the respondents strongly disagreed that they slept under the ITN only during pregnancy, 64 (34.6%) disagreed, 16 (8.6%) agreed, and 9 (4.9%) strongly agreed. Finally, 107 (57.8%) of the respondents strongly disagreed that their other children slept under the ITN, 64 (34.6%) disagreed, 8 (4.3%) agreed, and 6 (3.2%) strongly agreed.

Factors that influence ITN usage among Pregnant Women

The factors that influence the usage of ITNs have been categorised into personal factors, household factors, and institutional factors and presented below.

Personal Factors that Influence ITN Usage

As presented in Table 4, participants provided responses to statements on personal factors influencing the use of ITN among pregnant women.

Personal factors	Responses	Frequency (N)	Percentage (%)
I feel heat/warmth/sweat when sleeping under the ITN.	Strongly Disagree	4	2.2
	Disagree	5	2.7
	Agree	58	31.4
	Strongly Agree	118	63.8
I itch and have skin rashes when I sleep under the ITN.	Strongly Disagree	6	3.2
	Disagree	8	4.3
	Agree	71	38.4

	Strongly Agree	100	54.1
I have difficulty in hanging the ITN in my room.			
	Strongly Disagree	2	1.1
	Disagree	16	8.6
	Agree	63	34.1
	Strongly Agree	104	56.2
I have difficulty in breathing when sleeping under the ITN.	Strongly Disagree	5	2.7
	Disagree	17	9.2
	Agree	57	30.8
	Strongly Agree	106	57.3
I use mosquito spray, coils, and repellent instead of ITNs.	Strongly Disagree	4	2.2
	Disagree	3	1.6
	Agree	77	41.6
	Strongly Agree	101	54.6

Source: *Administered questionnaire (2022)*

Table 4: Personal Factors that Influence ITN Usage

From Table 4, the study found that majority of respondents 118 (63.8%) strongly agreed that they felt heat/warm then sleeping under the ITN, 58 (31.4%) agreed, 5 (2.7%) disagreed, and 4 (2.2%) strongly disagreed. Also, 100 (54.1%) of the respondents strongly agreed that they itched and had rashes when sleeping under the ITN, 71 (38.4%) disagreed, 8 (4.3%) disagreed, and 6 (3.2%) strongly disagreed. Again, 104 (56.2%) of the participants strongly agreed that they had difficulty in hanging their ITNs in their rooms, 63 (34.1%) agreed, 16 (8.6%) disagreed, and 2 (1.1%) strongly disagreed. Yet again, 106 (57.3%) of the participants strongly agreed that they had difficulty in breathing when sleeping under the ITNs, 57 (30.8) agreed, 17 (9.2%) disagreed, and 5 (2.7%) strongly disagreed. Finally, 101 (54.6%) of the respondents strongly agreed that they used mosquito spray, coils, and repellent instead of ITNs, 77 (41.6%) agreed, 3 (1.6%) disagreed, and 4 (2.2%) strongly disagreed.

Household factors influencing utilisation of ITN

Participants' response to household factors that influenced their use of ITNs has been presented in Table

Household factors	Responses	Frequency (N)	Percentage (%)
There is inadequate room space to hang the ITN.	Strongly Disagree	11	5.9
	Disagree	17	9.2
	Agree	75	40.5
	Strongly Agree	82	44.3
My household size is too large to sleep under an ITN.	Strongly Disagree	9	4.9
	Disagree	21	11.4
	Agree	65	35.1
	Strongly Agree	90	48.6
The number of ITNs in my household is few.	Strongly Disagree	98	53.0
	Disagree	74	40.0
	Agree	9	4.9
	Strongly Agree	4	2.2
The type of roof construction will not allow me to hang ITNs.	Strongly Disagree	9	4.9
	Disagree	5	2.7
	Agree	62	33.5
	Strongly Agree	109	58.9
My bed is too small making it difficult to hang the ITNs.	Strongly Disagree	7	3.8
	Disagree	13	7.0

	Agree	65	35.1
	Strongly Agree	100	54.1

Source: *Administered questionnaire (2022)*

Table 5: Household Factors that Influence ITN Usage

From Table 5, the findings of the study revealed that majority of respondents 82 (44.3%) strongly agreed that there is inadequate room space to hang the ITN, 75 (40.5%) agreed, 17 (9.2%) disagreed, and 11 (5.9%) strongly disagreed. Also, 90 (48.6%) of the respondents strongly agreed that their household size was too large to sleep under the ITN, 65 (35.1%) agreed, 21 (11.4%) disagreed, 9 (4.9%) strongly disagreed. Again, 98 (53.0%) of the respondents strongly disagreed that the number of ITNs in their household was few, 74 (40.0%) disagreed, 9 (4.9%) agreed, and 4 (2.2%) strongly agreed. Yet again, 109 (58.9%) of the respondents strongly agreed that their roof construction did not allow them to hang their ITNs, 62 (33.5%) agreed, 5 (2.7%) disagreed, and 9 (4.9%) strongly disagreed. Finally, 100 (54.1%) of the respondents strongly agreed that their beds were too small to hang their ITNs, 65 (35.1%) agreed, 13 (7.0%) disagreed, and 7 (3.8%) strongly disagreed.

Institutional factors that influence the use of ITN

Table 6 sought to present the response of participants on institutional factors that influence the use of ITN

Institutional factors	Responses	Frequency (N)	Percentage (%)
I had my ITN from the ANC clinic.	Strongly Disagree	2	1.1
	Disagree	4	2.2
	Agree	37	20.0
	Strongly Agree	142	76.8
The ITN was sold to me at the ANC clinic.	Strongly Disagree	172	93.0
	Disagree	13	7.0
	Agree	0	0.0
	Strongly Agree	0	0.0
ITNs are frequently distributed at ANC clinic.	Strongly Disagree	3	1.6
	Disagree	2	1.1
	Agree	81	43.8
	Strongly Agree	99	53.5
I have ever had guidance on how to hang ITN at ANC.	Strongly Disagree	88	47.6
	Disagree	78	42.2
	Agree	12	6.5
	Strongly Agree	7	3.8
I have ever had education on ITN usage at the ANC.	Strongly Disagree	93	50.3
	Disagree	76	41.1
	Agree	10	5.4
	Strongly Agree	6	3.2

Source: *Administered questionnaire (2022)*

Table 6: Institutional Factors that Influence ITN Usage

Institutional factors that influence ITN usage

The study as showed in Table 6 revealed that 142 (76.8%) of the respondents strongly agreed that they had their ITNs from the ANC clinic, 37 (20.0%) agreed, 4 (2.2%) disagreed, and 2 (1.1%) strongly disagreed. Also, 172 (93.0%) of the respondents strongly disagreed that the ITNs were sold to them at the ANC clinic, and 13 (7.0%) agreed. Again, 99 (53.5%) of the respondents strongly agreed that ITNs were frequently distributed at the ANC clinic, 81 (43.8%) agreed, 2 (1.1%) disagreed, and 3 (1.6%) strongly disagreed. Yet again, 88 (47.6%) of the respondents strongly disagreed that they ever had guidance on how to hang ITN at the ANC clinic, 78 (42.2%) disagreed, 12 (6.5%) agreed, and 7 (3.8%) strongly agreed. Finally, 93 (50.3%) of the pregnant women strongly disagreed that they had education on the usage of the ITNs at the ANC clinic, 76 (41.1%) disagreed, 10 (5.4%) agreed, and 6 (3.2%) strongly agreed.

5. Discussion of Results

The study findings revealed that almost all the pregnant women owned an ITN. These findings of high ownership of ITNs among pregnant women resonate with the findings of several previously published studies [20 & 25]. Similarly, the findings concords with the findings of a research on the usage of long-lasting insecticide-treated bed nets in Uganda, which found that the ownership of ITNs high among the population and were covered by 69.5 percent of the population [34]. A major inference of this finding is that a good number of the pregnant women who attended ANC in the Presbyterian hospital, Bawku owned ITNs. Therefore, the midwives and community health officers who provide direct care to pregnant women in ANC clinics should leverage on this finding to ensure that all pregnant women own at least one (1) ITN. The findings of the study indicate very low proportions of pregnant women utilising the ITNs. The pregnant women did not sleep under ITNs the night before the survey, they did not continuously sleep under ITNs throughout the year, and they did not sleep under the ITNs during pregnancy, but, slept under the ITNs only during the rainy season. This finding of very low utilisation of ITNs among pregnant women is in line with the findings of numerous earlier published surveys [21] that also identified low utilisation of ITNs among pregnant women.

Similar findings were reported in a study conducted in Northern part of Ghana by [14] among pregnant women which indicated just 23.1% utilization of the ITNs by households. [22] also reported that 83.4 percent of respondents possessed ITNs year-round, yet 13.8 percent utilized them during the rainy season, and 3.4 percent used them during the dry season among vulnerable populations (pregnant women and children under the age of 5) in the Northwest area of Cameroon. The inferences drawn from this finding of the study is that, the ownership of ITNs does not always resonate with the utilisation of ITNs among pregnant women. Therefore, given the important role ITNs play in the prevention of malaria and the cost incurred by countries to purchase the nets, there is an urgent need to develop pragmatic strategies to improve the utilisation of ITNs among the pregnant women. The findings of the current study indicated that the pregnant women felt heat and warmth when sleeping under the ITN, they itched and had rashes when sleeping under the ITN, they had difficulty in hanging their ITNs, and they also had difficulty in breathing when sleeping under the ITN. These findings concord with the findings of several other previous studies that also identified personal factors that influence the usage of ITNs among pregnant women [4,7,16-35]. Also, in two rural communities in the Greater Accra region of Ghana, a randomized control trial by found that more than 90% of respondents found ITNs to be uncomfortable to use because they trap heat, especially during warm weather or dry seasons where 75% of respondents could not sleep under an ITN without a fan. The chemicals used to disinfect the nets were said to have an unpleasant scent, which caused over 55% of pregnant women to vomit or have breathing problems, causing them to avoid sleeping under ITNs [2-8].

The findings of this study showed that the pregnant women had inadequate room space to hang their ITNs, had too large household size, their roof construction did not permit ITN usage, and had too small bed to hang their ITNs. The findings of this study aligns with the results a correlated study on the use of large-scale malaria control interventions in Ghana, key factors such as the structure of sleeping places, type of bed or structure slept on, were further noted as technical obstacles influencing ITN use [1]. In addition, a research on bed net usage found that residents' use of ITNs was hampered by the poor quality of their homes' roofs [15]. These results are similar to those found in Nigeria, where it was shown that the style of housing, household income, and housing conditions all independently affected the adoption of bed nets [24]. The study identified that the pregnant women had their ITNs from the ANC clinic, the ITNs were not sold to them, and ITNs were frequently distributed at the ANC clinic. However, the pregnant women never had guidance and education concerning ITN usage at the ANC clinic. These findings validate the findings of several other previous studies that also identified institutional factors that influenced ITN usage [4,19,20-29].

The findings of the study support a study the results from a randomized controlled cross-over trial in the greater Accra region of Ghana showing that pregnant women were more likely to sleep under the ITNs when given adequate guidance and education on how to correctly treat, hung, and use the nets. The study findings further indicated that, pregnant women who did not receive any information and guidance on net use, failed to consistently sleep under the ITNs [8]. The study findings calls for the need for stake holders to consider the specific individual, household and institutional factors when designing and rolling out such laudable interventions to ensure utility of the net for the prevention of malaria.

Limitation

The data collection instrument was written in the English language, and in some instances, questions were translated into different local languages of the respondents even though the instrument was validated. As such, it was possible that some vital information was lost during the translation process. However, the translation was done strictly to avoid any loss of meaning.

6. Conclusion

The study aimed to assess the ownership and utilization of ITNs among pregnant women in the Presbyterian hospital, Bawku. The study found that a high proportion of the pregnant women owned ITNs that were obtained freely from the ANC clinic. However, the study found that a disproportionally low proportion of the pregnant women actually utilized the ITNs. Among the factors that influences the utilization of the ITN, the study revealed that a combination of personal factors, household factors, and institutional factors influenced the utilization of the ITNs among the pregnant women.

Recommendations

Based on the conclusions drawn from the study, the following recommendations are made to the National Malaria Control Programme, the hospital and the Municipal Health Directorate.

National Malaria Control Programme (NMCP)

1. Modify and redesign the ITNs to include small sizes to make it easy to hang for those who live in mud houses roofed with thatch.
2. Continue the free distribution of ITNs and offer technical guidance on ITN usage during and after distribution of ITN so as to improve on level of net use among pregnant women.

Municipal Health Directorate

Train Community Health Officers (CHOs) with well-tailored knowledge on Behaviour Change Communication to address the needs of non-users at the community level.

Presbyterian hospital, Bawku

1. Carry out daily health education at the ANC on the appropriate and correct use of the ITNs as a preventive measure for mosquito bites and malaria.
2. Offer individual technical guidance and support to pregnant women on the effective way to use the ITN.

Future research: Future research should focus on using qualitative methods to explore the experiences of non-users of the ITNs to understand their feelings.

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Conflict of Interest Statement

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Ethics Statement

This study received approval from the Institutional Review Board (IRB) of the Kwame Nkrumah University of Science and Technology (KNUST) and the various Health Training Institutions used for this study. Informed consent was obtained from all respondents before data collection per ethical requirements.

Data Availability Statement

The data is available and can be requested from the corresponding author (Maximous Diebieri) at any time with an acceptable reason.

References

1. Afoakwah, C., Deng, X., & Onur, I. Malaria infection among children under-five: The use of large-scale interventions in Ghana. BMC Public Health, 18(1), 1–13.
2. Ahorlu, C. S., Adongo, P., Koenker, H., Zigirumugabe, S., Sika-Bright, S., Koka, E., ... & Monroe, A. (2019). Understanding the gap between access and use: a qualitative study on barriers and facilitators to insecticide-treated net use in Ghana. Malaria journal, 18(1), 1-13.
3. Alemu, M. B., Asnake, M. A., Lemma, M. Y., Melak, M. F., & Yenit, M. K. Utilization of insecticide treated bed net and associated factors among households of Kola Diba town, North Gondar, Amhara region, Ethiopia. BMC Research Notes, 11(1), 1–5.
4. Alfonso, Y. N., Lynch, M., Mensah, E., Piccinini, D., & Bishai, D. Willingness-to-pay for long-lasting insecticide-treated bed nets: A discrete choice experiment with real payment in Ghana. Malaria Journal, 19(1), 1–13.
5. Bawku Presbyterian Hospital. 2021 Annual Performance Review Report. (2021).
6. Blessed K, A., & Victor B, O. The Challenges of Using Insecticides Treated Nets (ITNs) in Curbing Malaria in Nigeria: A 2000-2018 Systematic Review. Journal of Infectious Diseases and Epidemiology, 6(4), 1–8.
7. Boadu, I., Nsemani, W., Ubachukwu, P., & Okafor, F. (2020). Knowledge and prevalence of malaria among rural households in Ghana. Journal of Community Medicine Health Education, 10(673), 2.
8. Briët, O. J., Yukich, J. O., Pfeiffer, C., Miller, W., Jaeger, M. S., Khanna, N., ... & Keating, J. (2017). The effect of small solar powered 'Bɔkɔɔ'net fans on mosquito net use: results from a randomized controlled cross-over trial in southern Ghana. Malaria journal, 16, 1-11.
9. Broom, M., Rychtár, J., & Spears-Gill, T. (2016). The game-theoretical model of using insecticide-treated bed-nets to fight malaria. Applied Mathematics, 7(09), 852-860.
10. Ernst, K. C., Erly, S., Adusei, C., Bell, M. L., Kessie, D. K., Biritwum-Nyarko, A., & Ehiri, J. (2017). Reported bed net ownership and use in social contacts is associated with uptake of bed nets for malaria prevention in pregnant women in Ghana. Malaria journal, 16, 1-10.
11. Ghana Health Service. 2017 ANNUAL REPORT NATIONAL MALARIA CONTROL PROGRAMME. (2018a).
12. Ghana Health Service. The Health System in Ghana: facts and Figures. internal-pdf://0240438844/Facts-and-figures-2015_GHS.pdf%0A
13. Ghana Statistical Service. Ghana malaria indicator survey 2019. (2020).
14. Kanmiki, E. W., Awoonor-Williams, J. K., Phillips, J. F., Kachur, S. P., Achana, S. F., Akazili, J., & Bawah, A. A. Socio-economic and demographic disparities in ownership and use of insecticide-treated bed nets for preventing malaria among rural reproductive-aged women in northern Ghana. PLoS ONE, 14(1), 1–13.
15. Kanyangarara, M., Hamapumbu, H., Mamini, E., Lupiya, J., Stevenson, J. C., Mharakurwa, S., Chaponda, M., Thuma, P. E., Gwanzura, L., Munyati, S., Mulenga, M., Norris, D. E., & Moss, W. J. Malaria knowledge and bed net use in three transmission settings in southern Africa. Malaria Journal, 17(1), 1–12.
16. Kim, S., Piccinini, D., Mensah, E., & Lynch, M. Using a human-centered design approach to determine consumer preferences for long-lasting insecticidal nets in Ghana. Global Health Science and Practice, 7(2), 160–170.
17. Koenker, H., & Yukich, J. O. Effect of user preferences on ITN use: a review of literature and data. Malaria Journal, 16(1), 1–18.

18. Manu, G., Boamah-Kaali, E. A., Febir, L. G., Ayipah, E., Owusu-Agyei, S., & Asante, K. P. Low utilization of insecticide-treated bed net among pregnant women in the middle belt of Ghana. Malaria Research and Treatment, 2017.
19. Mategula, D., Ndeketa, L., Gichuki, J., Zimba, B., Ching'ani, W., & Chipeta, M. G. Effect of bed net colour and shape preferences on bed net usage: a secondary data analysis of the 2017 Malawi Malaria Indicator Survey. Malaria Journal, 19(1), 1–10.
20. Mensah, E. A., & Anto, F. Individual and Community Factors Associated with Household Insecticide-Treated Bednet Usage in the Sunyani West District of Ghana Two Years after Mass Distribution. Journal of Environmental and Public Health, 2020.
21. Mutalemwa, P., Massue, D., Kisoka, W., Munga, M., Kabula, B., & Kisinza, W. "Should We Take Them or Leave Them?" A Qualitative Study to Understand the Social, Cultural, and Ethical Issues Associated With the Lifecycle Management of Insecticide-Treated Nets in Tanzania. East African Health Research Journal, 2(2), 135–141.
22. Ntonifor, N. H., & Veyufambom, S. Assessing the effective use of mosquito nets in the prevention of malaria in some parts of Mezam division, Northwest Region Cameroon. Malaria Journal, 15(1), 1–8.
23. Nyavor, K. D., Kweku, M., Agbemafle, I., Takramah, W., Norman, I., Tarkang, E., & Binka, F. Assessing the ownership, usage and knowledge of insecticide treated nets (ITNs) in malaria prevention in the hohoe municipality, Ghana. Pan African Medical Journal, 28, 1–8.
24. Ogunsanmi, O., Essang, A., Olaoye, T., Solademi, A., & Makinde, B. Insecticide Treated Nets Usage and Barriers Among PregnantWomen Attending Ante-Natal Clinic in Ogun State, Nigeria. European Scientific Journal, ESJ, 12(30), 67.
25. Omonijo, A., & Omonijo, A. O. Assessment of the Status of Awareness, Ownership, and Usage of Long-Lasting Insecticide Treated Nets after Mass Distribution in Ekiti State, Nigeria. Journal of Parasitology Research, 2019.
26. Opoku, R., Amoah, P. A., & Nyamekye, K. A. Householders' perception about sustaining the useful life of long-lasting insecticide-treated nets in Ghana. International Health, 1–6.
27. Polit, D. F., & Beck, C. T. (2008). Nursing research: Generating and assessing evidence for nursing practice. Lippincott Williams & Wilkins.
28. Ricotta, E., Oppong, S., Yukich, J. O., & Briët, O. J. T. Determinants of bed net use conditional on access in population surveys in Ghana. Malaria Journal, 18(1), 1–9.
29. Scates, S. S., Finn, T. P., Wisniewski, J., Dadi, D., Mandike, R., Khamis, M., Greer, G., Serbantez, N., Segbaya, S., Owusu, P., Mihigo, J., Gerberg, L., Acosta, A., Koenker, H., & Yukich, J. Costs of insecticide-treated bed net distribution systems in sub-Saharan Africa. Malaria Journal, 19(1), 1–18.
30. Short, R. E., Addison, P., Hill, N., Arlidge, W., Berthe, S., Castello y Tickell, S., Coulthard, S., Lorenz, L., Sibanda, M., & Milner-Gulland, E. J. Achieving net benefits: A road map for cross-sectoral policy development in response to the unintended use of mosquito nets as fishing gear.
31. Sougoufara, S., Sokhna, C., Diagne, N., Doucouré, S., Sembène, P. M., & Harry, M. The implementation of long-lasting insecticidal bed nets has differential effects on the genetic structure of the African malaria vectors in the Anopheles gambiae complex in Dielmo, Senegal. Malaria Journal, 16(1), 1–13..
32. Tejada, J., & Punzalan, R. On the Misuse of Slovin's Formula. University of the Philippines Diliman, 50(19), 129–136.
33. Trisos, C. H., Alexander, S. M., Gephart, J. A., Gurung, R., McIntyre, P. B., & Short, R. E. Mosquito net fishing exemplifies conflict among Sustainable Development Goals. In Nature Sustainability (Vol. 2, Issue 1, pp. 5–7). Springer US.
34. Wanzira, H., Katamba, H., & Rubahika, D. Use of long-lasting insecticide-treated bed nets in a population with universal coverage following a mass distribution campaign in Uganda. Malaria Journal, 15(1), 1–8.
35. Wekere, F. C. C., Kua, P. L., Kalio, D. G. B., Iwo-amah, R. S., & Harcourt, P. Assessing the Awareness , Ownership and Utilization of Insecticide- Treated Bed Nets amongst Antenatal Clinic Attendees : A Tertiary Hospital- Based Study. Asian Research Journal of Gynaecology and Obstetrics, 3(1), 21–29. (2020).
36. West, E. Ethics and Integrity in Research. Journal of Hospitality & Tourism Research, 13(1), 1–19.
37. World Health Organization. (2015). Global technical strategy for malaria 2016-2030. World Health Organization.
38. World Health Organization. Health and the millennium development goals. Archives of Disease in Childhood, 100, S48–S52.
39. World Health Organization. World malaria report 2019.
40. World Health Organization. Key facts on malaria (Issue January). (2020).
41. Yang, G. G., Kim, D., Pham, A., & Paul, C. J. A meta-regression analysis of the effectiveness of mosquito nets for malaria control: The value of long-lasting insecticide nets. International Journal of Environmental Research and Public Health, 15(3), 1–12.