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Insecticide Treated Nets Distribution and Malaria Infection in Argungu - Nigeria

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ABSTRACT: Insecticide Treated Nets (ITNS) is considered one of the most cost effective methods of malaria control. However, having ITNs does not confirm protection from malaria unless there is proper usage and strong adherence. The study was conducted to assess the distribution and utilization of ITNs in relation to malaria infection. The study was a cross sectional and structured questionnaire was used to retrieve information from the heads of households on their socio-demographic characteristics and compliance with insecticide treated nets utilization. The study subject's malaria infection status was also determined, using thick blood films stained with Giemsa stains. A total of 300 households were assessed, out of which 226(75.3%) had at least one ITN of which 62% were obtained during immunization. Only 173(57.7%) of these ITNs were utilized. Ownership was highest among civil servants (75.0%) and lowest among unemployed households (40.0%). Possession was higher among family > 10 members (84.2%) and least among those comprising 1 – 5 members (69.7%). Utilization was higher among family size 1 – 5 (65.6%) than in 6 – 10 (52.1%). Civil servants had the highest utilization rate (75.0%). Utilization was highest among pregnant women with higher literacy level (83.3%) and lowest in illiterate (30.2%). Infection increased among children under- five years, with males being more affected than the females. However, the infection decreased as the literacy level of the head of households increased. Infection was lowest among civil servants than among other businesses households. Proper utilization of ITNs significantly reduced malaria infection among the subjects studied.

KEYWORDS: Malaria, ITNs, Distribution, Utilization, Blood.

1 INTRODUCTION

Malaria a mosquito borne protozoal disease is considered a public health problem that is older than the recorded history of man, and probably plagued prehistoric man[1].The disease is transmitted by the bite of infected female *Anopheles* mosquito during a blood meal. Malaria in humans is caused by the four species of parasites of the genus *Plasmodium* namely, *P. falciparum, P. vivax, P.ovale,* and *P. malariae,[2]*. Malaria due to *P. falciparum* is the most deadly and, is predominant in Africa. *Plasmodium vivax* is less dangerous but more widespread, the other two species are found much less frequently.

It is estimated that 216 million episodes of malaria occur each year worldwide resulting in 655,000 deaths. It occurs mostly in poor tropical and subtropical regions of the world. This is due to the combination of factors such as the presence of mosquito vectors, predominant parasite species and socio-economic instability [2]. Eighty one percent of globally estimated cases of malaria occurs in Africa, with children under-five years of age and pregnant women being most severely affected [2].

In Nigeria, malaria is highly endemic and remains one of the most leading causes of morbidity and mortality which poses a major challenge to socio-economic development. It currently accounts for nearly 110million clinically diagnosed cases per year, 60% of outpatient visits and 30% hospitalizations, an estimated 300,000 children die of malaria each year and up to 11% of maternal mortality. In addition to the direct health impact of malaria, there is also a severe social and economic burden on country with about N132billion lost to malaria annually in form of treatment costs, prevention, lost of man's hour [4].

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Despite the fact that strong attempts to eradicate malaria have been made, the disease burden is still on the rise and some estimate that the number of cases could double in the next twenty years without the development of new methods for control [5]. This situation calls for a global concerted efforts towards management and control of the disease.

In Nigeria the use of ITNs is currently considered one of the most cost effective methods of malaria control. Regular use of ITNs by all those at risk of malaria infection is a key component of the national control programme. Despite these well known benefits of ITNs and the efforts of the Nigerian government to promote this intervention through mass distribution campaigns, many families and individuals at risk in the country do not own or use them. Studies that explore the determinants of use of insecticide treated nets are desirable. The study was aimed at assessing the distribution and utilization of ITNs in relation to malaria infection. Data to be obtained can be used to identify gaps in programme implementation and provide a scientific basis for policy decision on scaling up of intervention.

2 MATERIALS AND METHODS

2.1 STUDY AREA

Argungu is located North-West of Kebbi State Nigeria on the Southern bank of the river Rima, about 45km from the State Capital, Birnin-Kebbi. It is the home of the celebrated International Fishing and Cultural Festival. It is the headquarters of the Argungu Local Government Area with a population of about 47064 people [6]. This means of subsistence of the area is mainly river Rima. The river and its plain stretching about 334km wide provides ample opportunities for various horticultural activities which include cultivation of crops, fishing and cattle rearing. Fishing and rice cultivation are however the main occupation of the populace [7].

2.2 ETHICAL CONSIDERATION

Detailed explanation of the purpose, nature and all the processes involved in the research was made to the heads of the participating households. They were informed that their participation along with their children was voluntary and that they were free to decline from participating or to withdraw from partaking at any stage of the research, and their identities would not be disclosed to anyone. They were also informed that all children found with malaria parasites would be treated in accordance to the National Malaria Control Treatment Guidelines free of charge. Only households that gave informed verbal consent were recruited for the research.

2.3 RESEARCH DESIGN

The research was divided into two phases. In phase one, a thousand households were listed to form the sampling frame out of which 300 households were randomly selected. Structured questionnaires were then administered to the head of the households or their representative who must be not less than 18years of age. The questionnaire was adopted with modification from a research conducted in Swaziland by [8]. In the second phase, one child under-five years of age was randomly selected from each household for malaria diagnosis. Where there was more than one under-five years child in a household, they were given numbers and only one was selected by balloting. This was then followed by house to house visits to diagnose malaria among the selected members of the household under close supervision of the head of the households. At the point of blood collection for malaria diagnosis, information on age, sex, and use of ITNs last night was recorded for each under- five children.

2.4 BLOOD FILMS

The finger to be pricked was cleaned with 70% ethyl alcohol, and allowed to air dry, and then the side of fingertip was pricked with a sharp sterile lancet. A drop or two of blood were collected from the each selected persons and were dropped on a cleaned glass slide. It was then spread to make a thick smear using a spreader. The thick smears were then allowed to air dry.

2.5 STAINING PROCEDURE

Three percent Giemsa stain of pH 7.0 was poured on each thick blood smear and allowed to stand for 30 – 40 minutes on a staining rack [9]. The stain was then washed from the blood films using buffered distilled water. The slides were then drained on a filter paper and allowed to air dry.

2.6 MICROSCOPIC EXAMINATION

Stained slides were all examined under a microscope using x100 objective. The number of malaria parasites asexual parasitic forms on each slide were counted per 200 leucocytes [10] and recorded in the record book. A slide was considered negative if no parasites were found after 100 microscopic fields were scanned.

3 STATISTICAL ANALYSIS

The data obtained in this research was analyzed and expressed in term of percentage. Differences in socio-demographic characteristics were assessed between households with ITNs and those without ITNs, pregnant women using ITNs and those not using it, and between under-five children with malaria and those without malaria using Chi-square tests.

4 RESULTS

A total of 300 questionnaires were administered to the participating households. Out of these number 226(75.3%) households had at least one insecticide treated nets (ITNs) and 74(24.7%) had no ITN (table 1). The sources of ITNs were; antenatal care clinics, immunization and other sources (**Fig. 1**). Out of the 226 households that possessed at least one ITN, 62.0% were obtained during immunization, 11.9% from antenatal clinics, 12.4% from multiple sources and 13.7% from other sources. Possession of ITNs in relation to family size had shown that as the size of the family increased, the number of ITNs in the households also increased (table 1). Households having >10 members had the highest percentage, 84.2%, followed by those consisting of 6 – 10members, with 76.9%. Households with 2 – 5members had the least, 69.7%. The difference was however not statistically significant (X^2 = 4.67; df =2; P = 0.097).

Possession of ITNs in relation to occupation of the head of the households is on Table 2. Civil servants had the highest number of ITNs (88.9%), followed by households doing other businesses (76.2%). The farming households and unemployed households had 61.5% and 40.0% respectively. Total possession was observed to be 75.3%. The difference between group was statistically significant (X^2 = 30.9, df = 3; P = 0.000).

Table 1. Distribution of Insecticide Treated Nets in relation to Family Size in Argungu.

Family Size	Households with ITNs No.(%)	Households without ITNs No.(%)	Total
1-5	85(69.7)	37(30.3)	122
6-10	93(76.9)	28(23.1)	121
>10	48(84.2)	9(15.8)	57
Total	226(75.3)	74(24.7)	300

Key: ITNs= Insecticide treated nets

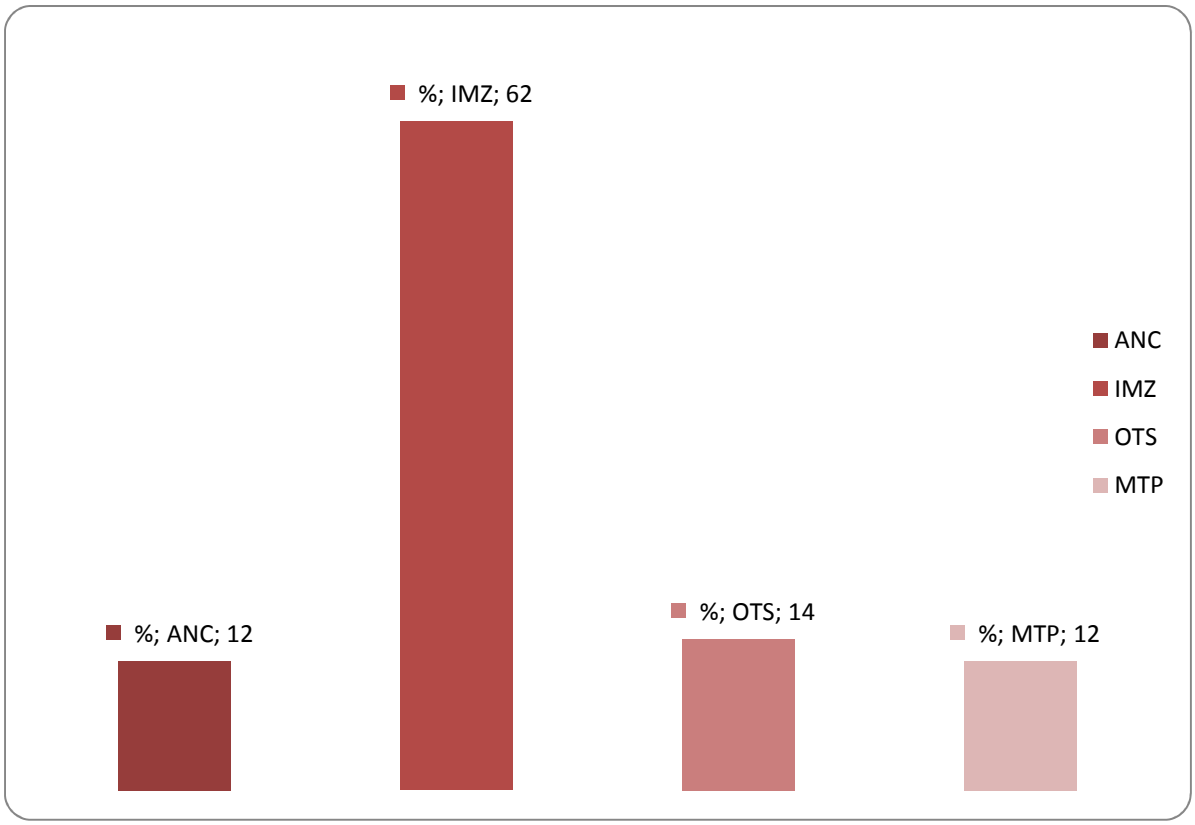

Fig. 1. Sources of Insecticide Treated Nets in Argungu.

Key: ANC = Antenatal Care, IMZ = Immunization, OTS = Other Sources, MTP = Multiple Sources.

Fig. 2 shows the utilization of ITNs in relation to family size. Family size with 1 – 5 members had the highest percentage of utilization of (65.6%), followed by those within the range of >10 members (52.6%). Least utilization is observed among those within 6 – 10 member range (52.1%). The difference was however not significant (X^2 = 5.27; df = 2; P = 0.072).

Table 2 presents ITNs utilization in relation to occupation. Civil servant had 75.0%, followed by households doing other businesses who recorded (52.4%). Farming and unemployed households recorded 40.0% each. The difference was significant (X^2 = 35.2; df =3; P = 0.000).

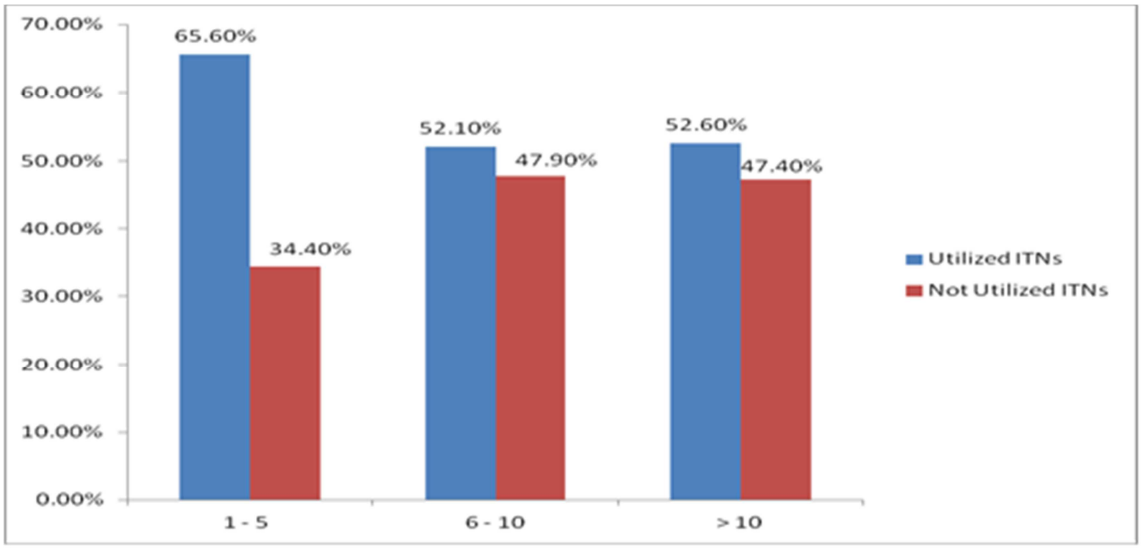

Fig. 2. Utilization of Insecticide Treated Nets in relation to Family Size of the study subjects in Argungu

Table 2: Possession and utilization of Insecticide Treated Nets in relation to Occupation of the study subjects in Argungu.

Occupation	HH with ITNs No. (%)	HH without ITNs No.(%)	Total HH	HH utilizing ITNs No. (%)	HH not utilizing ITNs No.(%)	Total HH
C/Servants	128(88.9)	16(11.1)	144	108(75.0)	36(25.0)	144
Farmers	80(61.5)	50(38.5)	130	52(40.0)	78(60.0)	130
Unemployed	02(40.0)	03(60.0)	05	02(40.0)	03(60.0)	05
Others	16(76.2)	05(23.8)	21	11(52.4)	10(47.6)	21
Total	226(75.3)	74(24.7)	300	173(57.7)	127(42.3)	300

Key:HH=Household

Insecticide treated nets utilization among pregnant women was positively and significantly association with literacy level (Fig. 3). Utilization of ITNs increases with increased literacy level. While 36.4% of pregnant women with primary education utilizes ITNs, 55.6% with secondary education utilizes its. As 83.3% of pregnant women with tertiary education utilizes ITNs, only 30.2% of the illiterate pregnant women utilizes ITNs (X^2 = 42.1; df = 3; P -= 0.000).

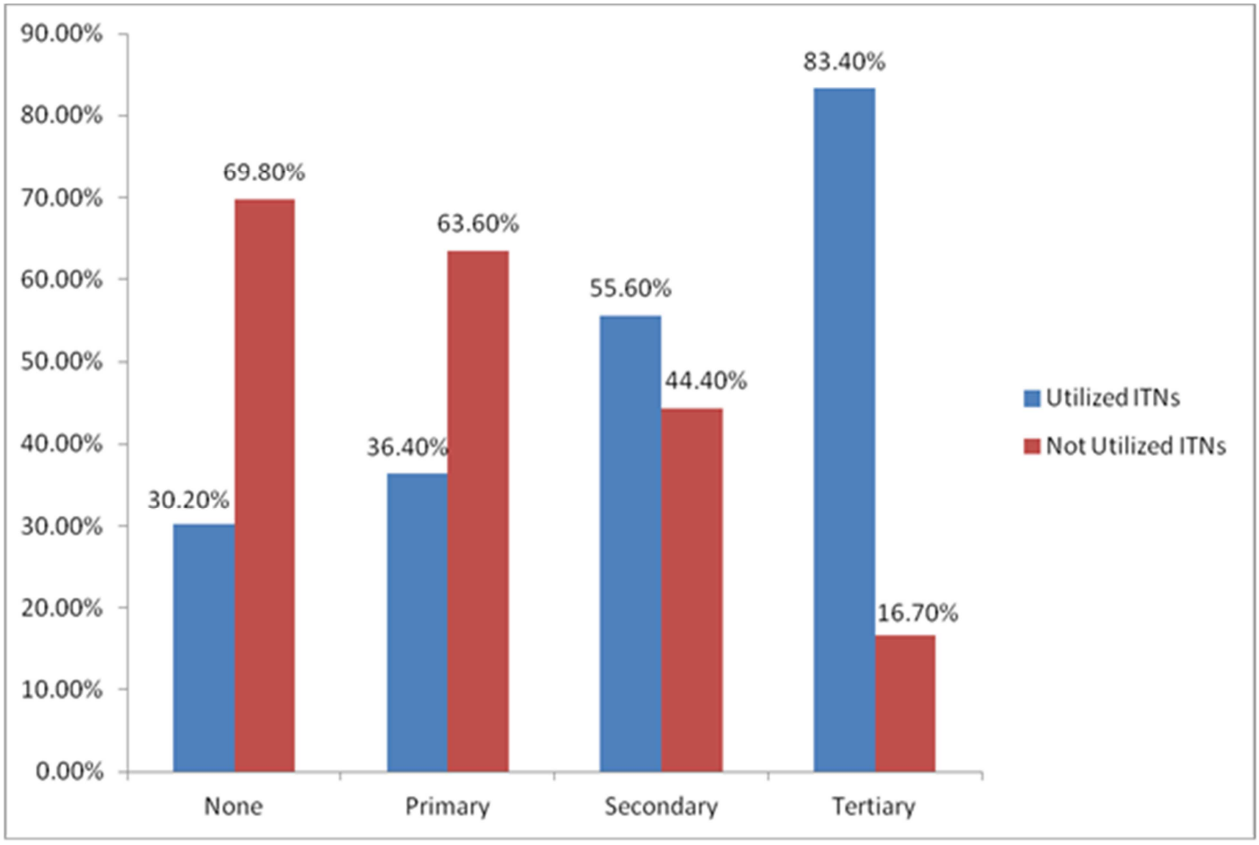

Fig. 3: Utilization of Insecticide Treated Nets by Pregnant Women in relation to Literacy Level in Argungu.

Prevalence of malaria infection in relation to age and sex among children under- five years of age was as shown in **table 3**. Prevalence was more among male, (25.0%) and less in female, (23.8%). Age specific prevalence had shown that children 4years of age had the highest prevalence (35.7%), followed by those with 3years (31.6%). Prevalence among subjects who were 2years old was 26.7%, and those with less than one and one year recorded zero prevalence. The difference between the group was significant statistically (X^2 = 23.4; P = 0.025).

Table 3: Prevalence of Malaria Infection among under five children in relation to Age and Sex in Argungu.

Age (years)	Male		Female		Total	
	No. examined	No. (%) infected	No. examined	No. (%) infected	No. examined	No. (%) infected
<1	10	0(0.00)	11	0(0.00)	21	0(0.00)
1	15	0(0.0.)	13	0(0.00)	28	0(0.00)
2	30	08(26.7)	23	06(26.1)	53	14(26.4)
3	19	06(31.6)	38	11(28.9)	57	17(29.8)
4	**42**	15(35.7)	45	14(31.1)	87	29(33.3)
Total	116	29(25.0)	130	31(23.8)	246	60(24.4)

Table 4 depicts prevalence in relation to ITNs utilization among children under five years of age by literacy level of the head of households. Among the children utilizing ITNs, those in the illiterate households recorded the highest prevalence (16.7%) and those in the households with tertiary education had the least (2.5%). Those in the households with secondary and primary education recorded 16.1% and 16.7% respectively.

Prevalence is also highest in the children of illiterate households (70.0%); among the households not utilizing ITNs. Prevalence in the households with primary, secondary and tertiary level of education was 64.3%, 60.0% and 55.6% respectively. The difference is however not significant (X^2 = 8.45; df = 9; P = 0.489). Prevalence is generally low among children utilizing ITNs (9.14%) and higher among those not utilizing ITNs (62.0%) irrespective of literacy level of the head of households.

Table 4: Prevalence of Malaria Infection in relation to ITN Utilization among under five years of age by Literacy Level of the Head of Households in Argungu.

Literacy level	Utilizing ITNs		Not utilizing ITNs		Total	
	No. examined	No. (%) infected	No. examined	No. (%) infected	No. examined	No. (%) infected
Illiterate	42	7(16.7)	20	14(70.0)	62	21(38.9)
Primary educ.	31	5(16.1)	14	9(64.3)	45	14(31.1)
Sec. educ.	22	2(9.1)	10	6(60.0)	32	8(25.0)
Tertiary educ.	80	2(2.5)	27	15(55.6)	107	17(15.9)
Total	175	16(9.14)	71	44(62.0)	246	60(24.4)

Table 5 shows prevalence, of malaria infection and utilization of ITNs among children under- five years of age by occupation of the head of households. Prevalence among households who utilizes ITNs was 41.6% in the children of the households who engaged in other businesses, 11.4% and 3.3% in the farming and civil servants households respectively. Those in the unemployed households recorded zero prevalence. In the households not utilizing ITNs, the prevalence were 80.0% in the children of households engaged in other businesses, 65.2% in the farming households, 54.3% among civil servants and 66.7% in the unemployed households.

Table 5: Prevalence of Malaria Infection in relation to ITN Utilization among under five years of age by Occupation of the head of households in Argungu.

Literacy level	Utilizing ITNs		Not utilizing ITNs		Total	
	No. examined	No. (%) infected	No. examined	No. (%) infected	No. examined	No. (%) infected
C/servants	91	3(3.3)	35	19(54.3)	126	22(17.5)
Farmers	70	8(11.4)	23	15(65.2)	93	23(24.7)
Unemployed	2	-	3	2(66.7)	5	2(40.0)
Others	12	5(41.6)	10	8(80.0)	22	13(59.1)
Total	175	16(9.14)	71	44(62.0)	246	60(24.4)

5 DISCUSSION

Malaria has been a major public health problem causing morbidity and mortality. Insecticide treated nets are the most cost-effective tools in the prevention of malaria. Studies that explore the determinants of distribution, ownership, use and effect of Insecticide treated nets on malaria have a major public health implication.

In this study, an equitable distribution of insecticide treated nets was observed among the study population. Two-third of the sampled households had ITNs (75.3%). This finding is consistent with other findings carried out by researchers like [11], who reported nets ownership in Kano to be 70%. This implies that the nets distribution programme is very much on course and had attained the roll back malaria target of 60% of ITNs coverage [12]. It is important to note that collaborating ITNs with immunization schedule was the best source of ITNs among the various sources of ITNs, 62% of the ITNs were obtained through immunization. This finding is in support of the work of [13]in Malawi reported that integration of ITNs distribution into routine immunization was well received both by caretakers and service providers.

Another notable observation in this study was that factors such as occupation and family size of the households were positively associated with possession of ITNs. As 88.9% of the households who were civil servants possessed ITNs, only 40.0% of unemployed households possessed it. This is understandable as civil servants tend to have better health seeking behavior as a result of their higher wealth index. Analysis of ITNs in relation to family size showed that there was increase in the number of ITNs per household with increase in size of the households. This is attributable to the presence of higher number of pregnant women / or children under five years of age (RBM priority group) in the households with higher members. However, this finding is in contrast with what was obtained by [11] in Kano. They recorded decrease in ITNs possession with increased family size.

Possession and appropriate utilization of ITNs do not automatically go hand in hand. In this study, only 57.7% ITNs were utilized, 42.3% of the distributed ITNs have not been put into use. Variables such as occupation and family size of the household appeared to be directly associated with ITNs utilization.

Impact of insecticide treated nets on preventing malaria may be minimized if they are not used by vulnerable population. In this study, utilization among pregnant women in relation to literacy level was investigated. Only 56.8% of the pregnant women utilized ITNs. This result corroborated evidence from other research conducted in Ethiopia by [14] who reported that 57.0% of pregnant women utilized ITNs. Literacy level was also shown to be very significantly associated with ITNs utilization among pregnant women. The rate of utilization increased monotonously with level of education. This is understandable as educated women tend to be more aware of malaria control measures and a better health seeking behavior, compared to their illiterate counterparts. This finding was supported by the work of [15] in South-East Nigeria who reported the likelihood that an individual to own or use a bed-net increased as the number of person's years of education increased.

The overall malaria prevalence among the households with children under five years of age was 24.4%. This is lower than the 38.0% recorded in Jos by [16]. This may be linked to higher ITNs utilization (57.7%) in this study compared to utilization (40.7%) in Jos's study. Prevalence is more in male (25.0%) compared to female (23.8%). This finding was however, in contrast with what was obtained in Jos by [16]. Children aged between less than one and one year had zero prevalence. This may be as a result of acquired immunity against malaria from their mothers. Prevalence was found to increase with age. This may be linked to the way people share sleeping structures in a household. When there are only a limited number of ITNs, it could be that priority is given to the younger children, or perhaps as the children grow older and experience fever episodes of malaria, there may be a false sense of protection leading to lower utilization of ITNs.

In this study, occupation was found to be positively associated with malaria infection. Children in the civil servants households had the least prevalence (3.3%) compared to their counterpart in the other businesses (45.5%). This is may be as a result of better knowledge of malaria control and higher wealth index among civil servants households.

6 CONCLUSION

The coverage of ITNs in the study area was higher than the 60% target of the Roll Back malaria initiative. However, not all ITNs owned by the households in the area were being used by under-five children and pregnant women. An appreciable number of the most susceptible groups are not protected from malaria using ITNs. This is linked to the lack of strong awareness campaign strategy on the distribution programs that explain and promote the benefit of ITNs usage. Knowledge of benefits and proper usage of ITNs will lead to total compliance with long term effect of increasing coverage and community wide benefits. While mass distribution campaign is able to rapidly achieve high ITNs ownership, it is unable to sustained continuous coverage for a population at risk for malaria as it only occurs at interval of five to ten years.

Having ITNs will only confer protection from malaria if there is proper usage and strong adherence. Malaria prevalence of 24.4% is still a major public health problem among people in the study area. It is imperative that ITN ownership and usage be sustained to keep the malaria prevalence low and in the long run move towards eradication and elimination. Proper ITNs distribution programme is a key to prevention and control malaria transmission.

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