



Pattern of Bednet Ownership and Usage of Insecticide Treated Bednet (ITN) among Pregnant Women in Nigeria (Review of 2003 and 2008 National Demographic and Health Survey [NDHS])

Olajide A. Adekunle¹, David M. Dairo^{1*} and Omowumi O. Okedare¹

¹*Department of Epidemiology and Medical Statistics, Faculty of Public Health, College of Medicine,
University of Ibadan, Oyo State, Nigeria.*

Authors' contributions

This work was carried out in collaboration between all authors. Author OAA managed literature searches, performed the statistical analysis, wrote the protocol, and wrote the first draft of the manuscript. Author DMD supervised the study and managed the analyses of the study while author OOO edited the manuscript. All authors read and approved the final manuscript.

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ABSTRACT

Introduction: Malaria in pregnancy imposes great burden on the country in terms of maternal morbidity, anaemia and low birth weights for children. World Health Organization (WHO) recommends insecticide-treated nets (ITN) usage for pregnant women to reduce the burden of malaria in pregnancy. There have been various interventions put in place by the government to make ITN available thereby ensuring usage but there has never been a documentation to describe the effectiveness of these strategies. This study reviewed the pattern of bed net ownership and ITN usage among pregnant women.

Methodology: This study was a comparative cross-sectional population based study in which a secondary data review and analyses of 2003 and 2008 national demographic and health survey (NDHS) data were done. Frequencies, charts and chi square test using Stat calc of Epi-Info statistical software were used to investigate the pattern of trend of ITN usage.

*Corresponding author: Email: drdairo@yahoo.com, ddairo@comui.edu.ng;

Results: Pregnant women who owned bed net increased significantly ($p < 0.05$) from 12.9% in 2003 to 22.9% in 2008. Pregnant women who slept under ITN also increased significantly from 1.2% in 2003 to 5.0% in 2008. There was a significant increase in the ownership of bed net and usage of ITN over the years in all the categories of residence, region, wealth index, education, literacy, partner's education, work status, marital status and religion.

Conclusion: This study found out that despite the fact that ITN was introduced widely across Nigeria, bed net ownership and ITN usage were still low and hereby calls for intensified campaign on awareness of practicing usage of ITN.

Keywords: Malaria in pregnancy; bed nets ownership; insecticide treated nets usage.

1. INTRODUCTION

Malaria being a public health problem in about ninety countries worldwide, it was estimated to be responsible for about 3,000 deaths per day worldwide [1]. According to Global progress and disease burden (2010–2015) [2], there were 212 million new cases of malaria worldwide in 2015 (range 148–304 million). The WHO African Region accounted for most cases of malaria (90%), followed by the South-East Asia Region (7%) and the Eastern Mediterranean Region (2%). In 2015, there were an estimated 429 000 malaria deaths (range 235 000–639 000) worldwide. Most of these deaths occurred in the African Region (92%), followed by the South-East Asia Region (6%) and the Eastern Mediterranean Region (2%) [2].

Malaria control still remains a challenge in Africa where 45 countries are endemic for malaria and in which over 500 million people are susceptible. Malaria in pregnancy is a major cause of morbidity and/or mortality in both the mother and her newborn baby. The situation is worse in first pregnancies as they are yet to develop immunity against *Plasmodium falciparum*, the major malaria parasite species causing malaria in pregnancy [3]. Pregnant women are particularly vulnerable to malaria because pregnancy reduces a woman's relative immunity to malaria, thus making her more susceptible to the infection and increasing the risk of illness, severe anaemia, and even death. This immune-suppression during pregnancy is more marked during the first 24 weeks of gestation than in the third trimester. Many researchers have reported high prevalence rates of malaria in pregnancy in different parts of Nigeria, ranging from 19.7% to 72.0% [4]. Thus, pregnant women need effective protective measures to ensure their survival and improve birth outcome. One of the WHO's recommendations for proper management of malaria during pregnancy is that pregnant woman should sleep under an Insecticide treated

bed net (ITN). Roll Back Malaria (RBM) was initiated in 1998 while ITN was introduced in 2001. The objectives were to rapidly scale up the country-wide and equitable distribution of ITN to pregnant women and to establish sustainable Public Private Mix (PPM) mechanisms for replacement of ITN. There were some laid-down targets which included the following: at least 80% of households must have two or more ITNs by 2010 and at least 80% of pregnant women should sleep under ITN by 2010 and sustain until 2013 [5]. To ascertain good coverage of ITNs across all states in Nigeria, the Federal Government/RBM partners procured and distributed about 10 million ITNs between 2000-2005 and additional 1.6 million ITN between 2006-March 2007. WHO's report in 2010 also showed that ITN distribution has increased from 3 million in 2002 to about 20 million in 2008 [6].

To achieve equitable distribution among pregnant women of different socio-economic status, the Federal Government introduced three major channels of ITN distribution. They are free distribution through mass campaigns and routine distribution (Antenatal Care), subsidized distribution through mass campaigns and community-based distributions and at cost ITN distribution through retail market, institutional sales and local production. There was also an integration of the distribution of ITN into antenatal care so that each pregnant woman can have access to ITN throughout Nigeria. To resolve the issue of cost and affordability, Federal Ministry of Health (FMOH) distribution scheme was focused on free ITNs to rural areas and poorer households combined with subsidized commercial ITN to urban and richer households [7]. ITN works well but coverage and usage are still the most important thing. With all the strategies and interventions put in place to make bed net and ITN available for pregnant women since the inception of RBM initiatives, a study has to be carried out to evaluate the effectiveness of these interventions. This study

therefore evaluated the pattern or trends of bed net ownership and ITN usage by pregnant women in Nigeria thereby revealing the difficulties that might hinder the achievement of the RBM goals.

2. METHODOLOGY

This is a comparative cross-sectional population-based study. It is a secondary data analysis of data of NDHS from 2003 and 2008. For this study, the ownership of bed net and usage of ITN among the pregnant women aged 15-49 years in Nigeria were compared using the 2003 and 2008 NDHS data using the primary survey, a national study [8,9,10] in Nigeria. Nigeria is made up of 36 states and a Federal Capital Territory (FCT), grouped into six geopolitical zones: North Central, North East, North West, South East, South South, and Southwest. The population covered by the 2003 and 2008 NDHS was defined as all women aged 15-49 in Nigeria while the units of enquiry were the pregnant women aged 15-49 years. The NDHS sample was selected using a stratified, two-stage cluster design consisting of a total of 365 clusters, 165 in urban areas and 200 in rural areas for 2003 survey and 888 clusters, 286 in the urban areas and 602 in the rural areas selected in 2008 survey. A total of 848 pregnant women of age group 15-49 were interviewed in 2003 while 3547 pregnant women were interviewed in 2008 for the ownership and usage of ITN. The primary data were collected using questionnaires administered to the selected pregnant women of age group 15-49 years. Window SPSS version 15.0 and Epi-Info software (Statcalc) were used for re-analyses of the available data. The independent variables reviewed were age of the pregnant women, residence (urban/rural), geopolitical zones, wealth quintile, education level, religion and marital status while the dependent variable were ownership of bed net and usage of ITN. The descriptive statistics such as frequencies were used to summarize quantitative variables while qualitative variables were summarized as proportions and in cross-tabulations. Frequencies, charts and chi square test using Statcalc of Epi-Info statistical software were used to investigate the pattern of trend of ITN usage. All analyses were done at 5% level of significance and 95% confidence interval. An ethical approval for the re-analyses was obtained from National Demographic and Health Survey (NDHS) in releasing the data related to malaria preventive and control measures among pregnant women of age group 15-49 in Nigeria.

3. RESULTS

A total of 848 and 3547 pregnant women were analysed in 2003 and 2008 respectively (Table 1). The age of the respondents ranged from 15-49 years with mean age of 27.0 years in 2003 and 27.1 years in 2008. The modal age of the pregnant women interviewed was 25 years in both 2003 and 2008. Majority (65.7% in 2003 and 73.2% in 2008) of the pregnant women interviewed were in the rural areas while 73.5% (2003) and 68% (2008) were from the northern parts of Nigeria. Less than half (41.7% in 2003 and 48.9% in 2008) were in the poor wealth index category, while 50% (2003) and 47.3% (2008) had no formal education.

Table 2 shows pattern of bed net ownership with respect to different socio-demographic characteristics of the respondents. Only 12.9% of pregnant women reported to have bed net in 2003. This proportion however increased to 22.9% in 2008. The pattern was however statistically significant. The proportion of pregnant women in urban residences who owned bed net increased over the years from 10.0% in 2003 to 21.3% in 2008 which was significant. There was also a significant increase in the proportion of rural dwellers who owned bed net from 14.4% in 2003 to 23.4% in 2008. Urban residence experienced a higher increase over the years. Overall, in the geopolitical regions in Nigeria, there was an increase in the proportion of those who owned bed net over the years although the increase was only significant in North East, North West, South East and South West regions. There was statistically significant increase in the proportion of pregnant women in the Northern and Southern parts of Nigeria who owned bed net from 2003 to 2008. Those in the Northern part experienced higher ownership of bed net than those in the Southern parts for both 2003 and 2008 though the increase in the Southern parts was higher than that of the Northern parts. In terms of wealth index, there was statistically significant increase in the pattern of bed net ownership over the years from 2003 to 2008 among the respondents in poorer, middle, richer and richest wealth indices except for those in the poorest wealth index who had little increase in proportion of ownership. Respondents in the rich wealth index category had lower percentage of bed net ownership in 2003 and had the highest percentage in 2008 as compared to those in the poor wealth index category. There was a statistically significant increase in bed net ownership among

respondents that had no education, primary and secondary over the years but there was no significant increase among those with higher education. There was a significant increase in the proportion of illiterate, partly illiterate and literate pregnant women that owned bed net from 2003 to 2008. There was also a statistical significant increase in the proportion of Christians and Muslims that owned bed net in their households from 2003 to 2008. Higher proportion of Muslim pregnant women owned bed net compared to Christians for both years though there was a higher increase among the

Christians. This was statistically significant. However, only 6.4% of respondents slept under any bed net in 2003 and there was a significant increase to 12.3% in 2008.

Table 3 shows the trend of any bed net usage among pregnant women from 2003 to 2008 with respect to their socio-demographic characteristics. It also shows that there was a statistically significant increase in the proportion of pregnant women that slept under any bed net from 6.4% in 2003 to 12.3% in 2008.

Table 1. Socio-demographic characteristics for pregnant women interviewed

		2003	2008
Variable		Number {Frequency (%)}	Number {Frequency (%)}
Residence	Urban	291 (34.3)	949 (26.8)
	Rural	557 (65.7)	2598 (73.2)
	Total	848 (100.0)	3547 (100.0)
Region	North Central	124 (14.6)	644 (18.2)
	North East	207 (24.4)	774 (21.8)
	North West	292 (34.4)	993 (28.0)
	South East	66 (7.8)	324 (9.1)
	South South	87 (10.3)	413 (11.6)
	South West	72 (8.5)	399 (11.2)
	Total	848 (100.0)	3547 (100.0)
	Region recode	North	623 (73.5)
South	225 (26.5)	1136 (32.0)	
Total	848 (100.0)	3547 (100.0)	
Wealth index	Poorest	181 (21.3)	954 (26.9)
	Poorer	173 (20.4)	782 (22.0)
	Middle	188 (22.2)	710 (20.0)
	Richer	170 (20.0)	567 (16.0)
	Richest	136 (16.0)	534 (15.1)
	Total	848 (16.0)	3547 (100.0)
Education	None	425 (50.1)	1676 (47.3)
	Primary	195 (23.0)	759 (21.4)
	Secondary	191 (22.5)	900 (25.4)
	Higher	37 (4.4)	212 (6.0)
	Total	848 (100.0)	3547 (100.0)
Marital status	Never married	17 (2.0)	87 (2.5)
	Currently married	819 (96.6)	3432 (96.8)
	Formerly married	12 (1.4)	28 (0.8)
	Total	848 (100.0)	3547 (100.0)
Religion	Christianity	303 (35.7)	1475 (41.6)
	Islam	534 (63.0)	1977 (55.7)
	Others	11 (1.3)	95 (2.7)
	Total	848 (100.0)	3547 (100.0)

Table 2. Pattern of bed net ownership by pregnant women

Variable	2003	2008	X ² value	P values
	Yes Number {Frequency (%)}	Yes Number {Frequency (%)}		
Bed net ownership	109 (12.9)	810 (22.9)	41.07	P < 0.05*
Residence				
Urban	29(10.0)	202(21.3)	18.53	P < 0.05*
Rural	80(14.4)	608(23.4)	22.09	P < 0.05*
Region				
North Central	13(10.5)	111(17.3)	3.57	P > 0.05
North East	47(22.7)	230(29.8)	4.00	P < 0.05*
North West	31(10.7)	230(23.2)	21.55	P < 0.05*
South East	7(10.6)	73(22.5)	4.78	P < 0.05*
South South	11(12.6)	78(18.9)	1.91	P > 0.05
South West	0(0.0)	88(22.1)	19.53	P < 0.05*
Region recode				
North	91(14.7)	571(23.7)	23.77	P < 0.05*
South	18(8.0)	239(21.0)	33.97	P < 0.05*
Wealth Index				
Poorest	33 (18.2)	182 (19.1)	0.08	P > 0.05
Poorer	27 (15.6)	190 (24.3)	6.09	P < 0.05*
Middle	19 (10.1)	180 (25.4)	20.17	P < 0.05*
Richer	20 (11.9)	136 (24.0)	11.31	P < 0.05*
Richest	10 (7.4)	122 (22.8)	16.45	P < 0.05*
Education Level				
None	68 (16.1)	382 (22.8)	9.11	P < 0.05*
Primary	23 (11.8)	172 (22.7)	11.26	P < 0.05*
Secondary	11 (5.8)	199 (22.2)	27.22	P < 0.05*
Higher	7 (18.9)	57 (26.9)	1.05	P > 0.05
Literacy				
Illiterate	78(15.1)	487(23.1)	15.68	P < 0.05*
Partly illiterate	3(6.3)	48(22.6)	6.67	P < 0.05*
literate	25(9.3)	273(22.9)	25.14	P < 0.05*
Partner's Education				
None	50 (15.6)	285 (21.6)	5.72	P < 0.05*
Primary	20 (10.0)	162 (22.5)	15.55	P < 0.05*
Secondary	15 (7.8)	199 (20.7)	17.65	P < 0.05*
Higher	17 (16.0)	140 (34.5)	13.45	P < 0.05*
Religion				
Christianity	27(8.9)	304(20.6)	22.75	P < 0.05*
Islam	81(15.2)	490(24.8)	21.94	P < 0.05*
Others	1(9.1)	14(18.9)	0.64	P > 0.05

*Significant at p<0.05

There was a significant increase in the proportion of pregnant women in urban and rural residences that slept under bed net from 2003 to 2008. All the geo-political regions in Nigeria experienced increase in the proportion of pregnant women that slept under bed net from 2003 to 2008 except for the South-South that dropped by 0.2%. There was a significant increase in the usage of bed net among the respondents that reside in the Northern and Southern parts of Nigeria over the years though higher proportion of the pregnant women in the Northern parts

slept under bed net both for 2003 and 2008. There was also increase in the proportion of pregnant women in various categories of wealth index that slept under any bed net from 2003 to 2008 though there were statistically significant increase for those in poorer, middle, richer and richest categories. Among the pregnant women in the various levels of education ranging from no education, primary, secondary education, there was a significant increase in the usage of bed net. Though there was a general increase in the proportion of illiterate, partly illiterate and literate

pregnant women that slept under bed net from 2003 to 2008. The increase among the illiterate and literate pregnant women was statistically significant. There was a statistically significant increase in the proportion of Christian and Muslim pregnant women that slept under bed net from 2003 to 2008 though higher proportion of Muslim pregnant women slept under bed net

more than the Christian pregnant women for both 2003 and 2008. While there was significant increase in the usage of any bed net among currently and formerly married pregnant women, there was a reduction in the proportion of pregnant women that were never married that slept under bed net from 23.5% in 2003 to 3.4% in 2008 which was significant.

Table 3. Pattern in association between Socio demographic variables and any bed net usage

Independent variables	2003	2008	X ² values	P values
	Yes Number {Frequency (%)}	Yes Number {Frequency (%)}		
Any bed net usage	54 (6.4)	438 (12.3)	24.53	P < 0.05*
Residence				
Urban	13 (4.5)	99 (10.4)	9.64	P < 0.05*
Rural	41(7.4)	339(13.0)	13.92	P < 0.05*
Region				
North Central	7 (5.6)	60 (9.3)	1.76	P > 0.05
North East	18(8.7)	127 (16.4)	7.59	P < 0.05*
NorthWest	18(6.2)	130 (13.1)	10.63	P < 0.05*
South East	3(4.5)	35 (10.8)	2.44	P > 0.05
South South	8(9.2)	37 (9.0)	0.089	P > 0.05
SouthWest	0(0.0)	49 (12.3)	9.87	P < 0.05*
Region recode				
North	43 (6.9)	317 (13.1)	18.37	P < 0.05*
South	11 (4.9)	121(10.7)	17.47	P < 0.05*
Wealth Index				
Poorest	17 (9.4)	112 (11.7)	0.83	P > 0.05
Poorer	12 (6.9)	115 (14.7)	7.42	P < 0.05*
Middle	12 (6.4)	96 (13.5)	7.05	P < 0.05*
Richer	8 (4.7)	68 (12.0)	7.51	P < 0.05*
Richest	5 (3.7)	47 (8.8)	3.98	P < 0.05*
Literacy				
Illiterate	40 (7.7)	288(13.6)	13.31	P < 0.05*
Partly illiterate	2 (4.2)	27 (12.7)	2.90	P > 0.05
Literate	12 (4.5)	121(10.2)	8.59	P < 0.05*
Partner's Education				
None	20(6.2)	160 (12.1)	9.17	P < 0.05*
Primary	11(5.5)	93 (12.9)	8.56	P < 0.05*
Secondary	7(3.6)	104 (10.8)	9.57	P < 0.05*
Higher	10(9.4)	70 (17.2)	3.89	P < 0.05*
Religion				
Christianity	13(4.3)	148 (10.0)	10.07	P < 0.05*
Islam	39 (7.3)	278 (14.1)	17.31	P < 0.05*
Others	2(18.2)	11 (14.9)	0.08	P > 0.05
Marital status				
Never married	4(23.5)	3 (3.4)	9.13	P < 0.05*
Currently married	50(6.1)	433 (12.6)	27.74	P < 0.05*
Formerly married	0(0.0)	2 (7.1)	0.90	P > 0.05

*Significant at p<0.05

Table 4. Pattern in association between socio-demographic variables and ITN usage from 2003 to 2008

Variables	2003		2008		X ² values	P values
	Yes Number {Frequency (%)}	Yes Number {Frequency (%)}	Yes Number {Frequency (%)}	Yes Number {Frequency (%)}		
ITN usage	10 (1.2)	176 (5.0)			22.46	P < 0.05*
Residence						
Urban	38 (3.4)	640 (16.8)			22.15	P < 0.05*
Rural	18 (0.9)	865 (8.2)			132.76	P < 0.05*
Region						
North Central	4 (0.8)	305 (12.1)			57.02	P < 0.05*
North East	14 (1.9)	223 (6.8)			26.26	P < 0.05*
North West	23 (2.4)	308 (7.7)			34.32	P < 0.05*
South East	1 (0.4)	144 (12.2)			32.05	P < 0.05*
South South	6 (2.1)	216 (12.5)			27.81	P < 0.05*
South West	8 (2.4)	309 (18.7)			55.24	P < 0.05*
Region recode						
North	41 (1.9)	836 (8.5)			6.84	P < 0.05*
South	15 (1.7)	669 (14.7)			112.84	P < 0.05*
Wealth Index						
Poorest	3 (0.4)	121 (3.1)			16.42	P < 0.05*
Poorer	5 (0.8)	193 (5.6)			28.19	P < 0.05*
Middle	10 (1.6)	333 (12.1)			59.24	P < 0.05*
Richer	16 (2.7)	476 (19.7)			99.16	P < 0.05*
Richest	22 (4.2)	382 (19.9)			72.73	P < 0.05*
Education						
None	12 (0.8)	364 (5.1)			55.87	P < 0.05*
Primary	13 (1.8)	356 (11.1)			61.18	P < 0.05*
Secondary	21 (3.0)	604 (18.3)			104.23	P < 0.05*
Higher	10 (9.7)	181 (25.7)			12.78	P < 0.05*
Literacy						
Illiterate	15 (0.8)	528 (5.9)			83.52	P < 0.05*
Partly illiterate	7 (3.5)	111 (11.8)			11.97	P < 0.05*
Literate	34 (3.5)	848 (19.5)			147.98	P < 0.05*
Partner's Education						
None	12 (1.0)	251 (4.4)			29.54	P < 0.05*
Primary	4 (0.6)	264 (9.3)			62.45	P < 0.05*
Secondary	20 (2.7)	589 (15.7)			90.95	P < 0.05*
Higher	18 (5.4)	335 (22.0)			49.60	P < 0.05*
Marital Status						
Never married	1 (1.3)	48 (13.9)			10.02	P < 0.05*
Currently married	52 (1.8)	1409 (10.3)			213.83	P < 0.05*
Formerly married	3 (2.9)	48 (14.2)			9.69	P < 0.05*
Religion						
Christianity	17 (1.5)	807 (13.6)			138.03	P < 0.05*
Islam	39 (2.1)	674 (8.3)			88.40	P < 0.05*
Others	0 (0.0)	13 (4.6)			2.60	P > 0.05
Currently working						
No	16 (1.4)	456 (8.7)			73.61	P < 0.05*
Yes	40 (2.1)	1045 (11.6)			158.00	P < 0.05*
Antenatal visit						
No	5 (0.5)	102 (1.8)			9.79	P < 0.05*
Yes	50 (2.6)	1281 (16.6)			258.64	

*significant at p<0.05

Table 4 shows the pattern of ITN usage among pregnant women from 2003 to 2008. It shows that there was also a statistically significant increase in the proportion of pregnant women who slept under Insecticide Treated Nets (ITN) from 1.2% in 2003 to 5.0% in 2008. Higher proportion of respondents in the urban residences slept under an ITN than those in the rural residences in both years. There was a general and statistically significant increase in the usage of ITN from 2003 to 2008 for urban and rural residence. There was significant increase in the usage of ITN among pregnant women in the geo-political zones from 2003 to 2008. There was a significant increase in the usage of ITN among pregnant women in Northern and Southern regions from 2003 to 2008. In 2003, there was similar proportion in usage of ITN in both the Northern and Southern regions but in 2008, there was an increase in usage in the Southern region compared to the Northern region. There was increase in the proportion of respondents in the categories of wealth index that slept under ITN. Those in the middle, richer and richest wealth indices slept under treated bed net more than those in the poorest and poorer categories both in 2003 and 2008. There was a significant increase in all the wealth index categories in ITN usage in both years under review, with usage increasing significantly from the poorest to the richest. Also, there was an increase in use of ITN with increase in education level in both 2003 and 2008. This increase was statistically significant in each level of education group in both the years. The literate pregnant women slept under ITN more than the illiterate pregnant women both in 2003 and 2008. There was a significant increase in the usage of ITN among all the categories of pregnant women. Partner's education level was seen to influence use of ITN among their wives in both review years. Pregnant women who had husbands with high level of education used ITN more than those whose husbands had little or no education and this was statistically significant. From this study, women who visited the antenatal clinic used ITN more than those who did not in both years and also recorded higher increase in usage in 2008. This observation is statistically significant. A significant increase in use of treated bed net in 2003 and 2008 was also observed.

5. DISCUSSION

WHO recommends that each household should have at least two bed nets and that pregnant

women should sleep under an Insecticide Treated bed net (ITN) as guidance on prevention and control of malaria among pregnant women. This study described the pattern of bed net ownership in households and usage of ITN among pregnant women in Nigeria.

5.1 Pattern of Bed Net Ownership among Pregnant Women

Bed net ownership among pregnant women varies with various independent socio-demographic factors from 2003 to 2008. The results showed that there was a general increase in the proportion of pregnant women who own bednet in their households from 2003 to 2008 which is also supported by the report published by NDHS [10]. Bed net ownership by pregnant women was higher in the rural areas compared to the urban areas which might be as a result of the focus of malaria preventive and control measures to the rural zones at the initiation of RBM. The implication is that more malaria episodes might occur in the urban areas which might cause upsurge of malaria endemic in Nigeria.

In terms of wealth index, more pregnant women in the poor category have bed net than those in the rich category in 2003 but in 2008, more pregnant women in the rich wealth index owned bed net compared to those in the poor category. This might be as a result of free distribution of bed net to the lower socio-economic status (SES) in the early stage of bed net introduction due to their weak affordability while the change in the ownership among the rich pregnant women might be as a result of high SES, good willingness to pay, and affordability. The result conforms to that of a study done by Guyatt and Snow [11] to evaluate the willingness to pay and ability to pay for ITN in Kenya. It was found out that about 97% of the housesteads were willing to pay for ITN. The implication of this outcome is that pregnant women in the rich household might have less burden of the disease while the poor pregnant women might experience a higher vulnerability to malaria because of their inability to afford or to pay for a bed net.

Education of the respondents and their partners followed the same pattern with proportion of those with higher education having bed net more than those in other levels of education. This shows that education is part of the instrument used in measuring socio-economic status (SES) that affects bed net ownership. This might cause

the lower class pregnant women who were unable to have quality education to have more malaria attacks during pregnancy.

Religion might also play a part in the explanation of pattern in the bed net ownership in which higher percentage of Muslim pregnant women had bed nets more than the Christians and those in other religion both in 2003 and 2008. This is however expected because higher percentages of the respondents interviewed in the years were from the Northern part of Nigeria where Islam religion is majorly being practised.

More pregnant women in the Northern part of Nigeria owned bed net in their household than those in the Southern parts of Nigeria in both the years. There was an increase from 2003 to 2008 which might be as a result of uneven distribution and availability of bed nets throughout the geopolitical zones of the country. This implies that pregnant women in the southern part of Nigeria are likely to have maternal parasitaemia compared to those in the Northern part.

5.2 Pattern of Any Bed Net Usage among Pregnant Women

Any bed net usage also shows a pattern different from that of ownership in which there was a slight decrease in the proportion of those that actually slept under bed net as compared to those that owned bed net. This was shown by a study carried out by Pettifor et al. [12] to describe bed net ownership and usage in Kinshasa, Democratic Republic of Congo (DRC). It was found out that among 351 women interviewed at the beginning of the study, 33% owned a bed net and 25% reported to have slept under the bed net the previous night. This showed that not all the pregnant women that owned bed net used them. Hence, achievement of RBM's goals might not be realistic if we focus only on distribution of bed net and neglect the actual usage of bed net. Individuals have given several complaints on the usage of bed net. It was emphasized in a study by Chukwuocha et al [13] that the cost of ITNs followed by their non-availability was constraints to their usage. Similarly, over half of participant in all the 10 Focus Group Discussions (FDGs) thought that the chemicals used to treat the nets were very harmful to adults, children and pregnant women. All these excuses show that there is a wrong or poor perception of usage of bed net.

Higher percent of pregnant women in the rural residences slept under bed net as compared to those in the urban residences both in 2003 and 2008. This is expected because most of the pregnant women in the urban areas might have other means of preventing malaria. The households might have door and window net and the respondents might use Insecticide repellent sprays, mosquito coils and creams which might not be practised by those in the rural areas.

There was no significant effect of education of the pregnant women and that of their partners/husband on the usage of bed net though there was an increase of bed net usage by pregnant women from 2003 to 2008. This is well supported by a study carried out in Zambia by Kaona et al. [14]. It was found out that knowledge of malaria has positive association with level of education but no significant relationship was found between education and the use of bed nets.

In terms of marital status, higher proportion of the singles slept under bed net in 2003 whereas in 2008, those that were currently married slept under bed net more than other pregnant women. All pregnant women experienced increase in the usage of bed net from 2003 to 2008 except the single pregnant women in which there was a reduction in the proportion that slept under bed net from 2003 to 2008. The implications this might have on the single pregnant women is enormous because most of them might be primigravidae which makes them more vulnerable to malaria thereby causing low birth weight for the baby, anaemia, premature delivery etc. This is supported by the study by Pettifor et al. [12] in which the married women were about 2.7 times more likely to have bed net and 3.2 times more likely to sleep under bed net than the singles. The married women are more likely to receive different types of support from their partner during pregnancy which might be different for the singles.

Malaria preventive strategies for pregnant women were incorporated into antenatal care for effective management of malaria in pregnancy. There was a great increase in the proportion of pregnant women that visited antenatal care that slept under bed net from 2003 to 2008 compared to the increase in the proportion of pregnant women. This shows a promising and positive effect in the usage of malaria preventive and control measures and increase in the awareness

and integration of the malaria interventions in antenatal care.

More Muslim respondents slept under bed net than the Christians respondents both for 2003 and 2008. This might be as a result of higher bed net ownership among the Muslim pregnant women.

The pattern of bed net usage can also be explained in terms of wealth index as one of the major socio-economic factors. The results showed that more women that belonged to poorest and poorer categories slept under bed net as compared to the richer and richest categories both in 2003 and 2008. This observation might be due to the fact that sleeping under bed net is the only available option for those in the poor category of wealth index because of their lower SES while those in the rich category might decide to use IPT, door and window net, IRS, mosquito repellent, creams.

5.3 Pattern of ITN Usage among Pregnant Women

The percentages of pregnant women that slept under ITN were still low both in 2003 and 2008 though there was a slight increase in the proportion from 2003 to 2008. This finding supports that of the study carried out by Carol *et al* [7] to evaluate gains in awareness, ownership and use of ITN in Nigeria and three other countries. It was found that 0% of pregnant women slept under ITN in 2000 while 4.4% slept under ITN in 2004 while 5% and 31% of pregnant women slept under ITN in 2000 and 2004, respectively, in Senegal.

Residence plays an important role in the usage of ITN. In 2003, more pregnant women in the rural areas slept under ITN but there was a change in 2008 in which more of the respondents in the urban areas slept under ITN. This might be as a result of free or subsidized distribution of ITN in the rural settlement than the urban areas. It might also be as a result of low SES, poor affordability and poor willingness to pay of the respondents in the rural areas. The increase in the urban areas might be as a result of high SES and good affordability of pregnant women. A similar picture regarding the relationship between SES and malaria-specific knowledge emerged from Malawi, where knowledge and appropriate use of ITN were found to be lower in rural (poorer) compared to urban (less poor) households [15].

In terms of wealth index, the pattern shows that there was a steady increase in the usage of ITN among pregnant women from poorest to richest for both 2003 and 2008 and also an increase in the usage from 2003 to 2008 for all the categories of wealth index. This shows that pregnant women in the richer category of wealth index slept under ITN than those in the poor category. This might be due to high SES, higher affordability and high willingness to pay for ITN among the pregnant women in the richer category of wealth index. Poverty still appears to be the most important barrier to net use with more than 80% of households without a net in one Malawian study reporting "lack of money" and 13% reporting "can't afford them" as the reason [15]. The authors of this study concluded that poverty and the expense of the ITN were the chief reasons for the lack of nets in these rural households. An ITN social marketing project in Tanzania found similar results, with the most common constraint on net ownership reported as affordability [16].

Level of education of pregnant women also played an important role in describing the pattern of ITN usage. The findings show that more pregnant women with higher education slept under ITN as compared to other levels both for 2003 and 2008. Also, pregnant women that have partners with higher education slept under ITN than other educational level for both 2003 and 2008. Net ownership/usage has also been related to the educational levels of households members. This is a complicated relationship since educational attainment can be a proxy for SES and is also likely to have an independent bearing on an individual's ability to understand and access information regarding malaria prevention methods. In Malawi it was found that net ownership was less common in households where the head/caretaker had not completed primary school and in homes where the house had mud walls or a grass roof (a proxy for low SES) [15]. There is some evidence to show that educational attainment is related to the acquisition of malaria specific knowledge. A study on ITN use in Benin [17] suggest that there may be a threshold effect, with ITN acquisition increasing among those men who have completed secondary, but not primary, education.

There was a significant association between working status of the pregnant women and the usage of treated bed net. Those that were not working slept under treated bed net more in 2003

compared to those working but higher percentage of pregnant women slept under treated bed net more in 2008. This might be due to the fact that those working have a higher affordability power to purchase ITN than those that were not working because of their earning power. This is however different from a study done in Democratic Republic of Congo in 2005. It was found out that women currently employed were about 0.6 times more likely to sleep under net [12].

6. CONCLUSION

It was found out that there was a general increase in proportion of bed net ownership, any bed net usage and ITN usage among pregnant women from 2003 to 2008 with different patterns with various independent variables. These results showed that there was a positive and progressive effect of the malaria interventions in reducing the prevalence of malaria in pregnancy in Nigeria. It was also found out that the major factors that were significantly associated to the pattern of bed net ownership, bed net usage and ITN usage among pregnant women were region recode, education, literacy, partner's education, work status, residence and religion. However, wealth index and residence were also found to have an association with ownership and usage of bed net.

7. RECOMMENDATIONS

To improve bed net ownership in Nigeria, bednets and ITN should be made available at a very affordable and subsidized price for all pregnant women in poor and middle categories of wealth index to be able to buy [18]. Advocacy should be done at all levels to policy makers so that there can be increased political will and commitment towards the promotion of equitable distribution of ITN to all pregnant women. In terms of ITN usage, there should be an increase in the level of awareness of the benefits of sleeping under bed net for pregnant women. They should be well educated on how to effectively use ITN to reduce the burden of malaria in pregnancy. There must also be a special focus on the pregnant women in the rural areas because most of them might have lower educational level, lower literacy level and lower socio-economic status. Campaign on the use of bed net should be intensified in order to educate more pregnant women on the benefit of using ITN effectively. Hence, proper and adequate awareness programmes should be put in place to

give the women the right perceptions of sleeping under bed net.

There must be a focus on the Northern parts of Nigeria because of the lower usage of ITN in the zone. Also, adequate healthcare facilities and practitioners must be in place at the rural areas to educate the dwellers on the benefits of ITN. Antenatal care clinic must be made affordable for pregnant women to visit so as to receive the adequate and necessary medical attentions during pregnancy. Electronic media and print, various informal communication methods can also be used to reach the disadvantaged sections of the illiterate and rural women. There is need for involvement of religious clerics in the promotion of malaria prevention so that religious beliefs would not deter the use of ITN as a preventive measure. Finally, equity focus in terms of residence, SES and geographical location should be improved and maintained at every stage of programme implementation.

CONSENT

Consent is not applicable.

ETHICAL APPROVAL

As per international standard or university standard, written approval of Ethics committee has been collected and preserved by the authors.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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