Iranian J Publ Health, Vol. 43, No.9, Sep 2014, pp.1192-1203

Original Article

Assessment of Pregnancy Status, Malaria Knowledge and Malaria Fever Morbidity among Women of Reproductive Ages in Nigeria

Abayomi Samuel OYEKALE

Dept. of Agricultural Economics and Extension, North-West University Mafikeng Campus, Mmabatho 2735 South Africa

***Corresponding Author:** Email: asoyekale@gmail.com

(Received 14 May 2014; accepted 20 July 2014)

Abstract

Background: Malaria is one the major health problem in Nigeria. During pregnancy, it poses serious threat to the survival of both unborn foetus and the mothers. This study determined the effect of adequate malaria knowledge and pregnancy status of women on use of mosquito nets and reported malaria fever morbidity.

Methods: The data were collected during the Malaria Indicator Survey (MIS) from 4632 women. Data analyses were carried out with descriptive statistics and Seemingly Unrelated Bivariate Probit regression.

Results: Results show that 13.19% of the women were pregnant, of which about one-third slept under mosquito nets. Also, 25.26% reported malaria associated fever in the previous two weeks to the time of interview, while 78.28% correctly answered that mosquitoes are responsible for malaria. Knowledge on malaria prevention was low with 55.70% and 14.93% indicating sleeping under mosquito nets and ITN, respectively. Probability of sleeping under mosquito nets significantly increased with knowing that sleeping under mosquito nets and ITN could prevent malaria while it decreased with having fever, age, urban residence and knowing that use of mosquito spray and coil can prevent malaria. The probability of having fever increased significantly with household size, being pregnant and age at first birth but decreased with age, knowing that sleeping under ITN, cutting grasses and closing door/windows would prevent malaria.

Conclusions: Use of mosquito nets among the women was low. Also, efforts to enhance their knowledge on malaria prevention and ensuring adequate access to mosquito nets especially for pregnant women would curtail the impact of malaria.

Keywords: Malaria, Pregnant, Knowledge, ITN, Mosquito nets

Introduction

Malaria parasites are transmitted from female *Anopheles* spp. of mosquitoes (1, 2). In tropical countries like Nigeria, eradication of malaria has been very difficult because of favourable climatic conditions for mosquito multiplication (3, 4). Timeliness in seeking treatment and its efficacy underscore the degree of incapacitation and the number of lost working days. In many malaria endemic countries, poorly developed healthcare system, poverty and unregulated infiltration of fake drugs often thwart efforts and initiatives to deliver efficient treatments (5).

The magnitude of economic burdens arising from malaria in many African countries, though often underestimated due to poorly developed health management information systems (6), makes it a ruthless public health problem with significant devastating potentials (7, 8). Globally, malaria is highly endemic in more than 100 countries with about 40% of total population at risk and more than 3 million mortality (9, 10). Available statistics have shown that without consideration of other deadly diseases, malaria possesses indomitable potentials to irreversibly alter demographic distribution of populations in strongly endemic areas as

one of the greatest world-wide public health challenges (6, 11).

In Africa, malaria annually threatens the health and successful outcomes of pregnancies of about 24 million women (12). Pregnant women, due to changes in the metabolic processes within their body systems often possess weak immunity against attacks and assaults from disease causing pathogens. However, a malaria attacks during pregnancy is serious infections due to rapid accumulation of malaria parasites in the placenta which ultimately reduces transportation of food nutrients to the foetus (13). Therefore, malaria is among the critical health challenges among pregnant women with approximately 19-24 million at risk (14, 15). Higher malaria vulnerability is expected of pregnant women from *P. falciparum* infection, most essentially those getting pregnant for the first time (16, 17). In addition, malaria is directly associated with more than 10% of death among pregnant women (5). Survival of born children would be compromised through low birth weight and malaria induced anaemia (18-21).

There have been several findings on the knowledge of Nigerian households on malaria. A study previously found that some households had good knowledge of the symptoms of malaria in infants and children (22). However, misconceptions and deficiency in adequate knowledge on the cause of malaria had been reported (23, 24). In Edo State, Nigeria, a study (25) found that peer education increased the knowledge of women on malaria with 64.8% and 73.6% providing correct answers before and after the education respectively. However, use of bed nets to prevent mosquito bites was reported to be very low with 11.60%. Another study (26) reported that pregnant women indicated that symptoms of malaria during pregnancy included abdominal pains and foetal weakness due to reduced kicks (53%), body pains and headaches (27%) and anaemia (20%). It was further reported that treatment methods used by the women were herbs (28%) and anti-malarial drugs (32%), while window/door nets and insecticide treated mosquito nets were used by 77% and 15% of the women, respectively.

Therefore, prescriptive stance for our ultimate preparedness to fight malaria now emphasizes possession of insecticide treated nets (ITN) and adoption of some behavioral attitudes to completely distort the development cycle of mosquito larvae. Health practitioners have explored several alternative options for reducing malaria infection. Among these are enhancing the understanding of societies on the role of mosquitoes in transmission of malaria parasites. This often calls for maintenance of essential hygiene in respect of drainage systems, clearing of bush in the surroundings, ensuring regular use of insecticide treated nets (ITNs), indoor spray of mosquito and insect killers. As primary caregivers, women's role in promoting family health cannot be underestimated and had been underscored in many researches (27). This implies that possession of adequate knowledge for taking some preventive and curative actions will go a long way in fostering sustainable pathway to reduce malaria infection. However, not many studies have probed into the knowledge of women on malaria determine their impacts on malaria infection during pregnancy and use of some preventive methods. This is the objective, which is a major gap that this study seeks to fill.

Materials and Methods

Study Area

Nigeria - blessed with a total land area of about 92,377,000 hectares, out of which about 91,077,000 hectares are solid land area-is one of the Sub-Sahara African (SSA) nations located in the western part of Africa. Beside Abuja which is the Federal Capital Territory, the country has 36 states. It is bounded by the Republic of Benin in the west, the Niger republic in the north, the republic of Cameroon and the Chad Republic in the east. Atlantic Ocean forms its coastline of about 960 km^2 to the south. The National Population Commission (NPC) putting the population at 88.5 million in 1991. The average rate of population growth is about 2.83 per cent per annum. About 140 million people lived in Nigeria in 2006 (28).

The tropical climate in Nigeria is characterized by wet and dry seasons which are directly associated with movements of rain-inducing southwesterly winds and the cold, dry and dusty northeasterly winds, respectively. The wet season is generally longer (April to September) in the southern parts of the country while dry season is generally longer in northern part. The average annual rainfall ranges between 600 and 2,650, while temperature oscillates between 25°C and 40°C. The northern part typically consists of Sahel grassland while mangrove swamp forest is found in the Niger Delta. Differences in climate, vegetation and soil properties are the bases for agricultural zoning with significant diversity in cultural practices, crop and livestock combinations (29).

Data and Sampling Methods

The 2010 Nigeria Malaria Indicator Survey (NMIS) aimed to measure the extent of progress in achieving the goals of the 2009-2013 National Strategic Plan for Malaria Control in Nigeria. The survey was carried out between October to December 2010 having being commissioned by National Malaria Control Programme (NMCP). The implementation was done by the National Population Commission (NPC) and other partners of Roll Back Malaria. More than 6,000 households were sampled and women aged 15-49 years were interviewed on malariaprevention during pregnancy, treatment of fever and knowledge of malaria transmission. The sampling frame for 2006 Population and Housing Census was used for the survey. The primary sampling unit (PSU) were defined based on the EAs for 2006 EA census frame. A total of 240 clusters were selected using stratified, two-stage cluster design with 83 in urban areas and 157 in rural areas. A total of 5895 households were selected, out of which 4632 were eligible for women questionnaire (29).

Analytical Methods

Analysing probabilities of sleeping under mosquito nets and reported malaria morbidity requires some econometric decisions and choices are to be made based on some conventional expectations. Probit or Logit regression is ideal for such modelling. However, the Seemingly Unrelated Bivariate Probit (SUBP) will be bestif sleeping under mosquito nets explains reported malaria morbidity which can also be influenced by several variables in a way of simultaneous equation. Suppose this holds, estimated parameters using conventional Probit or Logit regression will be biased and simultaneously equation should be used as discussed by Maddala (30). In this study, the structural form of the model will be stated as:

$$N_i = \alpha + \pi M_i + \beta_k \sum_{k=1}^{n} Z_i + v_i \quad .1$$

$$M_i = \gamma + \delta_k \sum_{k=1}^{n} Z_i + s_i \quad .2$$

N_i and M_i are latent variables for using mosquito nets and reported malaria morbidity respectively. The dependent variable N_i was estimated as dummy variables with values of 1 if sleeping under mosquito net and 0 otherwise. Also, M_i was estimated as 1 if reported to be sick of malaria in the previous fifteen days and 0 otherwise. Furthermore, $\alpha, \pi, \beta, \gamma$ and δ are the estimated parameters, while Z_i are the included covariates. Included covariates are contained in Table 1. The error terms of the model are dependent and distributed as a bivariate normal such that: $E(v_i) = E(s_i) = 0$, $var(v_i) = var(s_i) = 1$ and $\rho = cov(v_i, s_i)$.In the results from STATA software, Wald statistics which tests statistical significance of ρ was used to determine whether the models would be best estimated jointly in a recursive manner or not.

Results

Table 2 shows the descriptive statistics of women's socio-economic characteristics across the geo-political zones (GPZs) in Nigeria. It reveals that average age of women in the combined data was 31.74 years with standard deviation of 8.23. Women from southern GPZs were generally older with South East having the highest value (33.74 years). Average age of women was lowest in North West GPZ with 30.91. Similarly, ANOVA F-statistics of 13.70 reveals that there was statistical significant difference (P<0.01) between women's average ages across the Nigeria's GPZs.

Table 1: Description of variables used for parametric analysis

Variables	Mean (%)	Std. Dev.
Used Mosquito Nets	(34.26)	-
Sick of malaria in previous two weeks	(25.26)	-
Mosquitoes cause malaria	(78.28)	-
Stagnant water cause malaria	(10.62)	-
Certain food cause malaria	(4.64)	-
Other things cause malaria	(5.48)	-
Malaria prevented by sleeping under mosquito nets	(55.70)	-
Malaria prevented by sleeping under ITN	(14.94)	-
Malaria prevented by using insecticide spray	(17.96)	-
Malaria prevented by using mosquito coils	(22.88)	-
Malaria prevented by keeping doors/windows closed	(11.29)	-
Malaria prevented by cutting the grass	(5.35)	-
Malaria prevented by eliminating stagnant water	(7.06)	-
No knowledge of malaria prevention during pregnancy	(6.46)	-
Age of respondent at first birth	19.3832	4.79
Currently pregnant	(13.19)	-
Duration of pregnancy (months)	.66	1.88
Current age	31.74	8.23
North-Central zone	(16.90)	-
North-East Zone	(18.61)	-
North-West Zone	(22.00)	-
South-East zone	(12.97)	-
South-South Zone	(17.750	-
Urban residence	(29.17)	-
Years of education	3.57	9.82
Household Size	6.95	3.62
Wealth index	-8697.70	98317.71

Table 2: Descriptive statistics of selected demographic characteristics of women

		Current Age		Age at first birth		Household size		Yr of education		Wealth index	
		Mean	Std Dev	Mean	Std Dev	Mean	Std Dev	Mean	Std Dev	Mean	Std Dev
North Central	783	31.18	8.14	18.74	4.23	7.34	3.98	2.61	4.33	-22623.16	92790.92
North East	862	31.03	8.49	18.01	4.14	7.61	3.86	1.66	8.41	-81339.70	68996.32
North West	1,019	30.91	8.46	18.51	4.77	7.62	3.49	3.64	16.72	-53954.99	74381.40
South East	601	33.74	7.72	21.29	4.86	6.68	3.68	4.97	5.73	48531.33	74273.68
South South	822	31.77	8.14	20.15	5.03	5.86	2.72	4.69	5.12	42881.87	85419.86
South West	545	32.95	7.75	20.84	4.86	6.06	3.44	4.62	8.45	69917.30	92843.98
All women	4,632	31.74	8.23	19.38	4.79	6.95	3.62	3.57	9.82	-8697.70	98317.71

Average age at marriage in the combined data was 19.38 years. The women from northern zone generally marry at younger ages than those from southern parts. Women from North East zone had the lowest average age of marriage (18.01 years) while South East zone had the highest (21.29 years). There was statistical significant difference between the ages of women at marriage across the geopolitical zones ($F = 60.73$; $P<0.01$). Average household size in the combined data was 6.95, while northern zones generally recorded higher family sizes. Specifically, women from

North West zone had the highest average household size (7.62), while South South zone had the lowest (5.86). The ANOVA F statistics of 38.00 revealed that there was significant difference in the household sizes across the GPZs ($P<0.01$). Also, average year of education of the women in the combined data was 3.57. The results also show that average years of education in southern GPZs were higher than those from northern parts. The highest average year of education was reported by women from South East with 4.69, while North East had the lowest (1.66). Statistical difference existed between the years of education across the zones ($F=14.06$, $P<0.01$).

Demographic and Health Surveys do not always include data on incomes of households. However, wealth indices for individual households were generated from data collected on ownership of assets and access to basic housing facilities. In the results presented in table 2, average wealth indices were generally lower in northern zones. South West had the highest average wealth index (69917.30), while North East had the lowest (-81339.70). There was significant difference ($P<0.01$) in the wealth indices across the GPZs.

Table 3 shows the distribution of women that were sleeping under mosquito nets and reported fever in Nigeria's GPZs. It reveals that on the average, more women in northern parts of Nigeria slept under mosquito nets than those from the south. Precisely, women from North East had the highest percentage (59.86%) sleeping under mosquito nets, while South West had the lowest (10.46%). However, a similar trend was also found in reported fever with women from North West having the highest percentage (39.35%) while those from South West had the lowest (13.39%). In the combined data, about one-third of the women slept under mosquito net, while about one quarter reported fever in the previous two weeks.

Table 4 shows the knowledge of women on causes and prevention of malaria across their pregnancy status. It reveals that 13.19% of the women indicated to be pregnant at the time of the interview, of which about one-third slept under mosquito nets. Also, 25.26% of the women reported fever in the previous two week to the time of interview. However, about one third of th e pregnant women reported fever as against approximately one-quarter for those that were not pregnant.

The knowledge of the women on the causes of malaria was assessed in the survey. The results in table 4 reveal that 78.28% of the women correctly answered that mosquitoes are responsible for malaria. However, 79.21% of pregnant women answered this question correctly. However, only 10.62% of the women could link reproduction of mosquitoes to stagnant waters while 23.73% associated dirty surroundings to malaria. However, wrong conceptions were held by 0.52% and 4.64% of the women that associated malaria with drinking of beers and certain food, respectively. The survey probed into the knowledge of the women on how household members could avoid malaria. The women were asked about how malaria could be prevented during pregnancy.

Table 3: Incidences of women's sleeping under mosquito nets and reported fever across geo-political zones in Nigeria

Zone	Has no fever	Has fever	No nets	Slept under nets
North Central	86.46	13.54	75.61	24.39
North East	77.15	22.85	40.14	59.86
North West	60.65	39.35	53.19	46.81
South East	74.38	25.62	80.70	19.30
South South	70.92	29.08	72.02	27.98
South West	86.61	13.39	89.54	10.46
All	74.74	25.26	65.74	34.26

Table 4: Women's knowledge of malaria causes and prevention in Nigeria

Factor	Response	Not Preg-	Pregnant
Use of mosquito nets and reported fever			
Respondent slept under mosquito bed net	No	57.21	8.53
	Yes	29.60	4.66
Had fever in last two weeks	No	65.91	8.83
	Yes	20.89	4.36
Causes of malaria			
Mosquitoes	No	18.98	2.74
	Yes	67.83	10.45
Stagnant water	No	77.40	11.98
	Yes	9.41	1.21
Dirty surroundings	No	66.43	9.84
	Yes	20.38	3.35
Beer	No	86.38	13.11
	Yes	0.43	0.09
Certain foods	No	82.70	12.65
	Yes	4.11	0.54
Other things	No	81.80	12.72
	Yes	5.01	0.47
How to avoid malaria			
Sleep under mosquito net	No	38.60	5.70
	Yes	48.21	7.49
Sleep under an ITN/LLIN	No	73.83	11.23
	Yes	12.98	1.96
Use insecticide spray	No	71.20	10.84
	Yes	15.61	2.35
Use mosquito coils	No	66.77	10.34
	Yes	20.04	2.85
Keep doors/windows closed	No	77.24	11.46
	Yes	9.57	1.73
Use insect repellant	No	84.73	12.85
	Yes	2.07	0.35
Keep surroundings clean	No	64.36	9.87
	Yes	22.45	3.32
Cut the grass	No	82.21	12.44
	Yes	4.60	0.76
Eliminate stagnant water	No	80.51	12.44
	Yes	6.30	0.76
How pregnant women can avoid malaria			
Sleep under mosquito net	No	41.06	5.89
	Yes	45.75	7.30
Sleep under an ITN/LLIN	No	74.72	11.18
	Yes	12.09	2.01
Keep environment clean	No	66.06	10.10
	Yes	20.75	3.09
Take SP/Fansidar during pregnancy	No	68.18	10.60
	Yes	18.63	2.59
Take DARAPRIM medicine	No	83.47	12.65
	Yes	3.34	0.54
Others	No	83.18	12.46
	Yes	3.63	0.73
Don't know	No	81.00	12.54
	Yes	5.81	0.65

For the household members, the options that were probed into included sleeping under mosquito nets, sleeping under ITN/LLIN, using insecticide sprays, using mosquito coils, keeping doors and windows closed, using insect repellants, keeping surrounding clean, cutting the grass and eliminating stagnant water. The findings revealed generally low knowledge with 55.70% of the women indicating sleeping under mosquito nets. Also, 14.93% of the women highlighted sleeping under ITN/LLIN, 17.96% would use insecticide sprays, 22.88% would use mosquito coils while 11.29% would close their doors and windows to prevent entrance of mosquitoes. Similarly, to avoid malaria, only 5.35% and 7.06% of the women would cut the grass and eliminate stagnant water in their surroundings, respectively.

Furthermore, the women responded to questions on how malaria can be avoided during pregnancy. About one-half of the women indicated that malaria can be prevented during pregnancy by sleeping under mosquito nets. Also, 15.22% and 23.40% of the pregnant women indicated that sleeping under ITN/LLIN and keeping environment clean respectively would prevent malaria during pregnancy. Taking of fansidar and DARAPRIM medicines by pregnant women were indicated as ways of avoiding malaria by 21.22% and 3.89% of the women, respectively.

Factors influencing women's sleeping under mosquito nets and reported fever morbidity

Table 5 presents the results of Seemingly Unrelated Bivariate Probit regression. The diagnostic indicators show that the Wald Chi square statistics is statistically significant ($P<0.01$). This implies that the model produced a good fit for the data. The likelihood ratio test was statistically significant ($P<0.10$). This implies that the computed correlation coefficient between the error terms in the two estimated model (0.6846) is not statistically equal to zero. Therefore, estimating the models separately with Probit model would produce biased parameters.

The parameter of sick of fever in the model estimated for sleeping under mosquito nets is statistically significant ($P<0.01$) and with positive sign. This implies that the women that were sick of fever had lower probability of sleeping under mosquito nets, under variables being held constant. The results in table 5 further show that as the age of the women at firth birth increased, probability of having fever significantly increased ($P<0.01$). However, increase in current age significantly reduced probabilities of sleeping under mosquito nets and being sick of fever ($P<0.01$). The women that were currently pregnant also had significantly higher probability of having fever ($P<0.01$).

However, as the duration of pregnancy increases, probabilities of sleeping under mosquito nets and having fever significantly increased ($P<0.10$) and decreased ($P<0.05$) respectively. The variables that were included to capture the GPZs indicated that compared to those from South West, women that were resident in North Central, North East, North West, South East and South South had significantly higher probabilities of using mosquito nets ($P<0.01$). However, in the parameters estimated for fever model, North Central was statistically insignificant ($P>0.10$), while the other regional dummy variables were with positive sign and statistically significant ($P<0.01$). The results showed that women that were resident in North East, North West, South East and South South had significantly higher probabilities of having fever when compared to those from South West.

In addition, the results showed that the women that were resident in urban centers had significantly lower probability of sleeping under mosquito nets when compared to those from rural. The parameter of urban residence though statistically insignificant ($P>0.10$) in the fever model was with negative sign. Furthermore, while the parameter of household size in the sleeping under mosquito net is positive and statistically insignificant ($P>0.10$), it is statistically significant ($P<0.01$) in the fever model. This implied that as household size increased, probability of women having fever significantly increased. The parameter of sick of fever is with negative sign and statistically significant ($P<0.01$). This implies that probability of sleeping under mosquito nets decreased by 0.1220 among the women that had fever.

The results further indicated that none of the parameters for the knowledge of the causes of malaria showed statistical significance in the fever model ($P>0.10$). However, those women that answered yes to the question of whether mosquito is the causative organism of malaria had significantly lower probability ($P<0.05$) of sleeping under mosquito nets when compared with those that answered no. Similarly, those that answered yes to the question of whether stagnant water caused malaria had significantly lower probability of sleeping under mosquito nets ($P<0.05$) when compared with those that answered no. However, the women that possessed wrong knowledge that certain food cause malaria had significantly lower probability ($P<0.10$) of sleeping under mosquito nets when compared with those with proper knowledge.

Some of the parameters that were estimated for preventive knowledge of malaria showed statistical significance at different levels in the two models.

Table 5: Seemingly unrelated bivariate probit results of factors influencing use of ITNS and reported fever

Variables	Sleep under mosquito nets		Sick of fever	
	Parameter	z-value	Parameter	z-value
Sick of fever	-1.1520	-3.43	-	-
Knowledge of causes of malaria				
Mosquitoes	-0.1343	-2.17	0.0223	0.38
Stagnant water	-0.1425	-2.02	-0.0426	-0.57
Certain food	-0.2263	-1.85	0.1584	1.60
Other things	-0.1467	-1.38	0.1317	1.4
Malaria preventive knowledge				
Sleep under mosquito nets	0.4729	6.54	0.0646	1.21
Sleep under ITN	0.6362	5.13	-0.1426	-2.02
Use insecticide spray	-0.2163	-3.68	-0.0289	-0.49
Use mosquito coils	-0.1852	-3.52	-0.0511	-0.93
Keep doors/windows closed	-0.1136	-1.71	-0.1941	-2.72
Cut the grass	-0.0325	-0.31	-0.3709	-3.75
Eliminate stagnant water	-0.0767	-0.9	0.0800	0.92
No knowledge	-0.0970	-0.96	0.1649	1.94
Socio-economic factors and Pregnancy status				
Age of respondent at 1st birth	-0.0013	-0.23	0.0175	3.65
Currently pregnant	-0.1947	-1.05	0.4913	3.61
Duration of pregnancy (months)	0.0507	1.70	-0.0513	-2.07
Current age	-0.0141	-3.34	-0.0291	-10.28
North-Central zone	0.2767	2.89	-0.0155	-0.16
North-East Zone	1.2953	9.52	0.3057	3.09
North-West Zone	1.1098	12.38	0.8275	9.18
South-East zone	0.4124	4.21	0.4641	5.13
South-South Zone	0.6562	7.55	0.5413	6.26
Urban residence	-0.2460	-4.36	-0.0187	-0.35
Years of education	-0.0027	-1.40	-0.0019	-0.95
Household Size	0.0059	0.99	0.0165	2.74
Wealth index	0.0000	-0.66	0.0000	-1.44
Constant	-0.4521	-2.18	-0.6735	-4.74
Athrho	0.8377	1.96		
Rho	0.6846			

The women that knew that sleeping under mosquito nets and ITN could prevent malaria had significantly higher probability (P<0.01) of sleeping under mosquito nets when compared with those that did not. Similarly, the women that answered yes to the question of sleeping under ITN in order to prevent malaria had significantly lower probability of being sick of fever (P<0.05). Furthermore, the women that indicated that malaria could be prevented by using insecticide spray and mosquito coils had significantly lower probabilities of sleeping under mosquito nets (P<0.01). These variables did not show statistical significance in the fever model (P>0.10). However, the women that indicated preventing malaria through closing of doors and windows and cutting of grasses in the surrounding had significantly lower probabilities of having fever (P<0.01). The parameters of these variables did not show statistical significance in the model estimated for sleeping under mosquito nets. In addition, the women that lacked in any knowledge of malaria prevention had significantly higher probability of having fever (P<0.10) when compared with those with knowledge.

Discussions

Average age at first birth was lower in northern Nigeria. The women from the north were also on the average younger than their counterparts from Southern part. The issue of marriage is religiously and culturally defined in Nigeria. The results are in line with expectation given that in northern Nigeria, low educational pursuits among female children promote early marriages with substantial dominance of their elderly husbands. This practice of early marriage is intricately linked with some religious teachings which put some print of legality on behavior that is being criticized by several development stakeholders (31, 32).

Age at first birth was positively associated with probability of being sick of fever. However, if the women's current ages increased, the probabilities of using mosquito nets and sick of fever reduced. Similar findings had been previously reported (33, 34). The notion of reduced fever vulnerability as the age of women increased can be explained from expected development of immunity and their lower likelihood of being pregnant.

It was found that women from northern Nigeria had higher fertility than their counterparts from southern parts. The decision on household fertility is intricately linked to many demographic and socio-economic characteristics of the couples. It had been emphasized that in northern Nigeria, low education of female children could enhance decision for higher fertility (35). This is also essentially critical given predominance of polygamy (32). Fertility was also found to significantly increase probability of being sick with fever among the women. This can be traced to likely inability of women to sleep under mosquito nets as household size increases. Also, depending on the number of rooms, women may have some difficulties sleeping under mosquito nets when the household size is very large since the available nets may not be sufficient for everybody.

There was also generally low level of education among the women. Low average year of education was a reflection of differences in educational attainments across gender in Nigeria. It had been emphasized that in some instances, girl child would most likely be withdrawn from school in the event of unforeseeable economic adversity (36). Furthermore, some of the observed demographic and socio-economic characteristics of women from northern Nigeria would implicate their low socio-economic status. The results indicated that those women from northern parts of Nigeria had very low average wealth indices. These findings are in conformity with previous studies that emphasized the endemic nature of poverty in northern Nigeria, which ever poverty measures may have been used (37).

Episodes of fever are synonymous to malaria infection (38) although in many instances self-medication and dependence on traditional healers hinder substantial parasitological confirmations (39). Over the years, women as primary care givers at home always have acquired some knowledge of associated symptoms of malaria as one of the most common causes of morbidity among household members. Therefore, fever, headache and

joint pains are critical symptoms to be watched out for before deciding whether to administer malaria drug or not (39). The findings indicate that fever morbidity was more reported in northern Nigeria; despite that many of the women were sleeping under mosquito nets. This is evidently revealed in both the descriptive and parametric analyses. In recent time, several efforts had been made to distribute mosquito nets freely in many Nigerian states. Presently, many states in northern Nigeria had been covered, while only few had been covered in the southern parts of the country. This could have explained higher usage of mosquito nets in northern Nigeria. However, inability to prevent entrance of mosquitoes into dwellings may expose household members to their deleterious bites, even before sleeping under the nets. This is also emphasizing the need for adequate window and door netting in the efforts towards prevention of malaria (40).

It had been noted that due to rapid changes in their body's metabolic processes, pregnant women often have higher susceptibility to disease infection (40). The notion of avoiding miscarriages that could be triggered by malaria infection often makes informed pregnant women to sleep under mosquito nets or use other malaria preventive methods. In the results, about one out of three pregnant women was sleeping under mosquito nets. During anti-natal, pregnant women are often educated through routine health talks that are delivered by some health professionals. This can trigger some form of behavior change. In the parametric analysis, it was found that pregnant women had higher probability of being sick of fever. This is expected because malaria infection during pregnancy can be significant due to rapid weakening of their immunity) 40). It was also found that the probability of being sick of fever reduced as the duration of pregnancy increased.

There have been several hindrances to use of mosquito nets even when household possesses them. In some instances, it had been noted that the temperature under the net could so high, thereby constitute some sleeping disturbances. The implication is that without access to functioning electrical fans, it may be difficult for household members to regularly use mosquito nets. In a study in Uganda, Mbonye et al. (13) found that utilization of ITN was low due to high cost, the believe that the chemicals being used to it treat it are dangerous to pregnant women and the fetus, low utilization of antenatal care, lack of support from husband in preventing malaria and perception that adolescents that are pregnant for the first time have higher immunity towards malaria.

Close to four out of five women correctly associated malaria morbidity with mosquito bites. In another study in urban areas of North Central Nigeria, 89.47% of the women correctly associated malaria with mosquito bites (41). Possession of adequate knowledge is a prerequisite for ensuring that the right preventive actions are taken against multiplication of mosquitoes. However, ability to link dirty environment, presence of stagnant water and bushy environment to multiplication of malaria was very limited. This could also be directly linked to low educational attainment of majority of the women.

Likewise, testing the recursiveness of the specified model, the women that were sick of fever had lower probability of sleeping under mosquito nets. This is expected because mosquito nets had been found to be effective in preventing malaria (42). It should also be emphasized that possession of right knowledge of malaria preventive methods reduced probability of being sick of fever and increased probability of sleeping under mosquito nets. However, women that were had the knowledge of preventing malaria through use of insecticide spray and mosquito coils had lower probabilities of sleeping under mosquito nets. The safety of the fetus should however be ascertained before exposing themselves to those gasses.

Conclusion

There are some public health policy issues arising from the study. First, there is the need for marginal health reforms targeted at malaria control among young women especially those being pregnant for the first time. Second, there is the need for family planning awareness creation to ensure

access of every household member to mosquito nets. Third, there is the need to promote public health initiatives to enhance the knowledge of women on malaria preventive and curative methods. Finally, enforcement of legislations on environmental sanitation and creation of awareness on the need for clean drainage systems so that breeding of mosquitoes can be thwarted will assist in curtailing the spread of malaria.

Acknowledgement

The author is grateful to the Measure DHS for granting the permission to use the data. The author declares that there is no conflict of interests.

References

1. Russell PF (1965). *Man's Mastery of Malaria*. London: Oxford University Press. 308pp.
2. Foster WD (1965). *A History of Parasitology*. Edinburgh: Livingstone. Pp 201.
3. Filler S, Causer LM, Newman RD, Barber AM, Roberts JM, MacArthur J, Parise ME, Steketee RW (2003). Malaria surveillance - United States, 2001. *MMWR Surveill Summ*, 52:1–14.
4. Owusu-Ofori AK, Betson M, Parry CM, Stothard JR, Bates I (2013). Transfusion-transmitted malaria in Ghana. *Clin Infect Dis,* 56:1735-1741.
5. Musa OI, Salaudeen GA, Jimoh RO (2009). Awareness and use of Insecticide Treated Nets among women attending ante-natal clinic in a Northern state of Nigeria. *J Pak Med Assoc*, 59(6): 354-358.
6. Cox FEG (2010). History of the discovery of the malaria parasites and their vectors. *Parasites & Vectors*, 3:5.
7. Hlongwana KW, Zitha A, Mabuza AM, Maharaj R (2011). Knowledge and practices towards malaria amongst residents of Bushbuckridge, Mpumala--nga, South Africa. *Afr J Prm Health Care Fam Med*, 3(1), Art. #257, 9 pages.doi:10.4102/phcfm. v3i1.257.
8. Agyepong IA, Kangeya-Kayonda J (2004). Providing practical estimates of malaria burden for health planners in resource-poor countries. *Am J Trop Med Hyg*, 71(Suppl.2):162−167.
9. WHO/UNICEF. (2005). *World Malaria Report 2005*. World Health Organization and UNICEF, WHO/HTM/MAL/2005.1102.
10. Sachs J, Malaney P (2002). The economic and social burden of malaria. *Nature*, 680-685.
11. Muturi EJ, Burgess P, Navak RJ (2008). Malaria vector management: where have we come from and where are we headed? *Am J Med Hyg*, 78: 536-537.
12. WHO (2002). *Roll Back Malaria Geneva*. Factsheet. World Health Organization Geneva. Available from: http://mosquito.who int/docs/FSI-html.
13. Mbonye AK, Neema S, Magnussen P (2005). Preventing malaria in pregnancy: a study of perceptions and policy implications in Mukono district, Uganda. *Health Policy and Plann*, 21(1):17-26.
14. Snow R, Craig M, Deichmann U, Marsh K (1999). Estimating mortality, morbidity and disability due to malaria among African's non-pregnant population. *Bull Wld Hlth Org*. 77:624-640.
15. Guyatt HL, Snow RW (2001). The Epidemiology and burden of *Plasmodium falciparum*-related anemia among pregnant women in sub-Saharan Africa. *Am J Trop Med Hyg,* 2001;64(suppl 1):1-106.
16. McGregor IA, Wilson ME, Bilewicz WZ (1983). Malaria infection of the placenta in the Gambia, West Africa, its incidence and relationship to birth weight and placenta weight. *Trans R Soc Trop Med Hyg*, 93: 529–534.
17. Steketee RW (1989). Recent findings in perinatal malaria. *Bull of the International Paediatric Association* 10: 418–33.
18. McCorwick M (1985). The contribution of low birth weight to infant and childhood morbidity. *N Engl J Med,* 321: 82–90.
19. Bloland P, Slutsker L, Steketee RW, Wirima JJ, Heymann DL, Breman JG (1996). Rates and risk factors for mortality during the first two years of life in rural Malawi. *Am J Trop Med Hyg,* 55 (Suppl. 1): 82–86.
20. Steketee R, Wirima JJ, Hightower AW, Slutsker L, Heymann DL, Breman JG.. (1996). The effect of malaria and malaria prevention in pregnancy on offspring birth weight, prematurity and intrauterine growth retardation in rural Malawi. *Am J Trop Med Hyg,* 55 (Suppl. 1): 33–41.
21. Slutsker L, Bloland P, Steketee RW, Wirima JJ, Heymann DL, Breman JG (1996). Infant and second year mortality in rural Malawi: causes and descriptive epidemiology. *Am J Trop Med Hyg,* 55 (Suppl. 1): 77–81.
22. Idowu C, Mafiana I, Luwoye, O, Adehanloye O (2003). Perceptions and home management practices of malaria in some rural communities in

Abeokuta, Nigeria. *Travel Med Infect Dis*, 6:210 - 214.

23. Erhun WO, Agbani EO, Adesanya SO (2004). Malaria prevention: knowledge, attitude and practice in a south western Nigerian community. *Afr J Biomed Res*, 8:25-29.
24. Wagbatsoma VA, Obomighie JE, Nwokike NH (2004). Home management of malaria in an academic community – University of Benin, Benin City, Nigeria. *JMBR: A Peer-Rev J Biomed Sci,* 3, 73-80.
25. Mens PF, Scheelbeek PFD, Atabbi HAI, Enato EFO (2011). Peer education: the effects on knowledge of pregnancy related malaria and preventive practices in women of reproductive age in Edo State, Nigeria. *BMC Public Health,* 11:610.
26. Sam-Wobo SO, Akinboroye T, Anosike J, Adewale B (2008). Knowledge and practices on malaria treatment measures among pregnant women in Abeokuta, Nigeria. *Tanz J Health Res,* 10(4):226-231.
27. Hlongwana KW, Zitha A, Mabuza AM, Maharaj R (2011). Knowledge and practices towards malaria amongst residents of Bushbuckridge, Mpumalanga, South Africa. *Afr J Prm Health Care Fam Med*, 3(1), Art. #257, 9 pages.doi:10.4102/phcfm.v3i1.257
28. National Bureau of Statistics (2009). *Annual Abstract of Statistics (2009).* National Bureau of Statistics, Abuja, Nigeria.
29. National Population Commission (NPC) (Nigeria) (2012). National Malaria Control Programme (NMCP) (Nigeria), and ICF International. *Nigeria Malaria Indicator Survey 2010*. Abuja, Nigeria: NPC, NMCP, and ICF International. Available from: https://dhsprogram.com/pubs/pdf/MIS8/MIS8.pdf.
30. Maddala G (1983). *Limited Dependent and Qualitative Variables in Econometrics*, Econometrics Society Monograph, No 3, Cambridge University press, New York.
31. UNFPA (undated). Early Marriage in Nigeria. Available from: http://nigeria.unfpa.org/nigeirachild.html
32. Action Health Incorporated (2011). *Insights into Early Marriage and Girls' Education in Northern Nigeria*, AHI, Lagos, Nigeria.
33. Marielle KBA, Denisa EIC, Modeste MM, Eric K, Pierre BM, Elie M, Maryvome K (2003). Prevalence of Plasmodium falciparum infection in pregnant women in Gabon. *Malar J*, 2:1–17.
34. Adam I, Khamis AH, Elbashir MI (2005). Prevalence and risk factors for Plasmodium falciparum malaria in pregnant women of eastern Sudan. *Malar J*, 2005, 4:18.
35. Riley N (1997). Gender, power and population change. *Pop Bull*, 52(1): 1 – 52.
36. Okorodudu, RI, Igun SE (2002). Analysis of contemporary trend of gender education in Nigeria: implication for nation building. *J Nigerian Soc Society* 1(1): 89 – 113.
37. Oyekale AS., Lawal O, Onu ME (2013). Non-income Assessment of Pro-poor Growth and Programmes in Nigeria, Policy Brief, GP_No. 04/July, African Economic Research Consortium (AERC), Nairobi, Kenya.
38. Animut A, Gebre-Michael T, Medhin G, Balkew M, Bashaye S, Seyoum A (2008). Assessment of Distribution, Knowledge and Utilization of Insecticide Treated Nets in Selected Malaria Prone Areas of Ethiopia. *Ethiop J Health Dev.* 22(3):268-27439.
39. Premium Times *for All Africa,* (2013). Nigeria: battling malaria without drugs or knowledge. Available from: http://www.premiumtimesng.com/news/131470-nigeria-battling-malaria-without-drugs-or-knowledge-by-ogechi-ekeanyanwu.html.
40. Babalola M (2013). An examination of the association between malaria knowledge and bed net use of pregnant women receiving antenatal care at Federal Medical Centre, Abeokuta, Nigeria. *Public Health Theses,* Paper 269.
41. Olayemi IK, Omalu ICJ, Abolarinwa SO, Mustapha OM, Ayanwale VA, Mohammed AZ, Bello IM, Chukwuemeka VI (2012). Knowledge of malaria and implications for control in an endemic urban area of North Centrl Nigeria. *Asian J Epidemiol,* 5(2) 42-49.
42. Onwujekwe O, Chima R, Okonkwo P (2000). Economic burden of malaria illness on households versus that of all other illness episodes: a study in five malaria holo-endemic Nigerian communities. *Health Pol*, 54:143-159.