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Impact of Socio-Economic Factors and Indwelling Mosquito Control on Malaria Prevalence among Pregnant Women in Nigeria Using Logistic Regression Model

[*1,2]Adenomon, Monday Osagie.; [1]Obazee, Osazee Femi & [3]Vance, Eric

1. Department of Statistics, Nasarawa State University, Keffi, Nigeria & NSUK-LISA Stat Lab, Nasarawa State University, Keffi, Nigeria
2. Foundation of Laboratory for Econometrics and Applied Statistics of Nigeria (FOUND-LEAS-IN-NIGERIA)
3. Director, LISA 2020 Networks, University of Colorado Boulder, USA.

*Corresponding Authors: adenomonmo@nsuk.edu.ng; femoba2000@gmail.com; Eric.Vance@colorado.edu; +2347036990145

Abstract

Malaria is endemic in Nigeria and remains a major public health problem, taking its greatest toll on children under age 5 and pregnant women, although it is preventable, treatable, and curable. This study investigates the Impact of socio-economic factors and indoor mosquito control on malaria prevalent among pregnant women in Nigeria using logistic regression. To achieve this, secondary data obtained from 2015 Nigeria Malaria Indicator survey, executed by the National Malaria Elimination Programme (NMEP) and the National Population Commission (NPopC), with a nationally representative sample of more than 8,000 consisting of 7,745 households. The results from the logistic regression with odds ratio revealed that pregnant women are more like to be affected by malaria fever (though not significant) compared to women that are not pregnant. The income levels of the household does not significant reduce the incidence of malaria fever among pregnant women in Niger. Concerning the malaria presenting measure, only dwelling sprayed by private company significantly reduce the incidence of malaria fever among pregnant women (P-value=0.020<0.05) compared to dwelling sprayed by government and NGOs and also to Insecticide Treated Net. Also pregnant women in the urban centers are less likely to have malaria fever compared to pregnant women in rural communities in Nigeria. Also, pregnant women with atleast a secondary school level of education are less likely to be affected by malaria fever compared to pregnant women with no formal education. The fitted logistic model passed the goodness-of-test fit; the classification test for the logistic model was correctly classified at about 67.02%. Therefore, this study recommends that government and NGOs should intensify their efforts in the area of dwelling spraying, awareness campaign of the danger of malaria fever among pregnant women and infants, engaged in effective distribution of insecticide treated net in order to reduce the incidence of malaria fever among pregnant women living in rural communities in Nigeria.

Keywords: Malaria, Indoor Malaria Control, Insecticide Treated Net (ITN), Pregnancy, Socio-Economic, logistic Regression, Odds Ratio.

1.0 Introduction

Malaria in pregnancy can lead to the following: infant mortality, low birth weight, anemia and maternal death (WHO, 2019). In addition, malaria kills over 100,000 African infants each year and causes for 20 percent of low birth weights. Since pregnancy is high in Sub-Saharan Africa, over 50 million pregnant women in urban and rural communities are exposed each year to malaria parasites. According to Inah et al., (2017) Nigeria had a malaria burden of over 97% of the population are at risk of malaria of which the risk accounting about 30% of the total burden in Sub-Saharan Africa. Within this burden of malaria in Nigeria, pregnant women and children under 5 years are the most vulnerable groups for malaria parasite (Ikoli and Solomon, 2014). As a results of the huge danger of malaria parasite, World Health Organization (WHO) and other international Agencies are seeking ways to reduce malaria especially among pregnant women and children under 5 years (WHO, 2017 & 2019). The means of reducing malaria in Nigeria by international agencies are scaling up of vector control through long-lasting insecticidal nets (LLINs)(Onwuka et al., 2016; Omonijo & Omonijo, 2019) and indoor residual spraying (IRS) (Yakob, et al., 2011) and, Intermittent Preventive Treatment in Pregnancy (IPT), as well as the introduction of ACT and improved malaria diagnostic (FmoH, 2015). Despite these interventions the prevalence remains high among the pregnant women and children under five years (Ikoli and Solomon, 2014).

Due to the high prevalence of malaria among pregnant women, one may ask the following questions: Does the use of Insecticides Treated Net and Indoor Residual Spray have significant effects on Malaria eradication in Nigeria?; What other means can be employ in combination with the use of IRS and ITN to eradicate Malaria in Nigeria?; What socio-economic factors can reduce malaria fever among pregnant women in Nigeria?. Hence this study seeks to answers the above following questions.

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2.0 Brief Empirical Review of Previous Studies

This section presents some empirical review of previous studies related to this study:

Agomo et al., (2009) studied the prevalence of Malaria in pregnant women in Lagos, South-West Nigeria. A total of 1084 pregnant women were recruited into this study. The study revealed a Malaria prevalence of 7.7 % in the population while young maternal age and gravity posses an increase risk factors.

Aliyu, et al., (2017) used a cross sectional study to investigate the prevalence of Malaria among pregnant women attending selected secondary Health facilities in Kaduna State, Nigeria. Chi-square statistic showed that out of 353 pregnant women that participated in the study, the prevalence of Malaria was 22.4%.

Inah et al. (2017) investigated the prevalence of Malaria among pregnant women and children less than five years in Abi local Government Area, Cross River state. The study used cross-sectional data of 59 pregnant women and 166 children (0-59) in selected health centres between September 2016 to October 2016. They employed Chi-square analysis and their result revealed a high Malaria prevalence among pregnant women between the age brackets of 22-26 years. Also, Malaria was higher among Children between 0-12 Months.

Owoeye et al., (2018) examined the decomposition of Changes in Malaria prevalence amongst under- five Children in Nigeria between 2003 and 2013. They employed Multivariate Decomposition technique to partition the changes and their result revealed a decline from 31.8% to 13.1% between 2003 and 2013 in Malaria prevalence among under-five children in Nigeria.

Tegegne et al., (2019) examined prevalence of Malaria among pregnant women in Ethiopia. The search items from many sources such as google scholar, Pub med etc. And Meta analysis was used in the analysis. Among a total of 10207 studies the estimated pooled prevalence of Malaria among pregnant women in Ethiopia was 12.72%. They further suggested that Malaria prevalence among pregnant women was found relatively higher compared with the general population.

Bajoga et al., (2019) Investigated the trend of Malaria cases in Kaduna state using data from January 2011 and December 2015. Within this period,1,031603 Malaria cases was recorded while 238 deaths were also recorded . The trend analysis revealed a downward trend and Malaria cases was highest among children of ages 12-59 months while Malaria death was highest among children of ages 1-11 months.

3.0 Model Specification

3.1 Logistic Regression

Logistic regression is a statistical method for analysing a dataset in which there are one or more independent variables that determine an outcome (Usman, 2019). The outcome is measured with a dichotomous variable (in which there are only two possible outcomes).

$$logit(p) = b_0 + b_1X_1 + b_2X_2 + b_3X_3 + \ldots + b_kX_k$$

where p is the probability of presence of the characteristic of interest. The logit transformation is defined as the logged odds:

$$odds = \frac{p}{1-p} = \frac{probability\ of\ presence\ of\ characteristic}{probability\ of\ absence\ of\ characteristic}$$

and

$$logit(p) = \ln\left(\frac{p}{1-p}\right)$$

Rather than choosing parameters that minimize the sum of squared errors (like in ordinary regression), estimation in logistic regression chooses parameters that maximize the likelihood of observing the sample values (Long and Freese, 2001).

The logistic regression coefficients are the coefficients b_0, b_1, b_2, ... b_k of the regression equation:

$$logit(p) = b_0 + b_1X_1 + b_2X_2 + b_3X_3 + \ldots + b_kX_k$$

While the alternatives form of the logistic regression equation is:

$$\theta = \frac{e^{(\alpha + \beta_1 x_1 + \beta_2 x_2 + \ldots + \beta_i x_i)}}{1 + e^{(\alpha + \beta_1 x_1 + \beta_2 x_2 + \ldots + \beta_i x_i)}}$$

Where α = the constant of the equation and, β = the coefficient of the predictor variables.

By taking the exponential of both sides of the regression equation as given above, the equation can be rewritten as:

$$odds = \frac{p}{1-p} = e^{b_0} \times e^{b_1X_1} \times e^{b_2X_2} \times e^{b_3X_3} \times \ldots \times e^{b_kX_k}$$

It is clear that when a variable X_i increases by 1 unit, with all other factors remaining unchanged, then the odds will increase by a factor $e^{b}{}_{i}$.

$$e^{b_i(1+X_i)} - e^{b_iX_i} = e^{b_i(1+X_i) - b_iX_i} = e^{b_i + b_iX_i - b_iX_i} = e^{b_i}$$

This factor $e^{b}{}_{i}$ is the odds ratio (O.R.) for the independent variable X_i and it gives the *relative* amount by which the odds of the outcome increase (O.R. greater than 1) or decrease (O.R. less than 1) when the value of the independent variable is increased by 1 units (Usman, 2019).

3.1.1 ROC curve analysis

Another method to evaluate the logistic regression model makes use of ROC curve analysis. In this analysis, the power of the model's predicted values to discriminate between positive and negative cases is quantified by the Area under the ROC curve (AUC). The AUC, sometimes referred to as the c-statistic (or concordance index), is a value that varies from 0.5 (discriminating power not better than chance) to 1.0 (perfect discriminating power).

3.1.2 Wald Test:

A Wald test is used to test the statistical significance of each coefficient (β) in the model. A Wald test calculates a *Z* statistic, which is:

$$z = \frac{\hat{B}}{SE}$$

This z value is then squared, yielding a Wald statistic with a chi-square distribution. However, several authors have identified problems with the use of the Wald statistic. Menard (1995) warns that for large coefficients, standard error is inflated, lowering the Wald statistic (chi-square) value. Agresti (1996) states that the likelihood-ratio test is more reliable for small sample sizes than the Wald test.

3.1.3 Likelihood-Ratio Test:

The likelihood-ratio test uses the ratio of the maximized value of the likelihood function for the full model (L_1) over the maximized value of the likelihood function for the simpler model (L_0). The likelihood-ratio test statistic equals:

$$-2\log\left(\frac{L_0}{L_1}\right) = -2[\log(L_0) - \log(L_1)] = -2(L_0 - L_1)$$

This log transformation of the likelihood functions yields a chi-squared statistic. This is the recommended test statistic to use when building a model through backward stepwise elimination (Usman, 2019).

3.1.4. Hosmer-Lemshow Goodness of Fit Test:

The Hosmer-Lemeshow test is a statistical test for goodness of fit for the logistic regression model (Hosmer and Lemeshow, 1989 & 2013). The data are divided into approximately ten groups defined by increasing order of estimated risk. The observed and expected number of cases in each group is calculated and a Chi-squared statistic is calculated as follows:

$$\chi^2_{HL} = \sum_{g=1}^{G} \frac{(O_g - E_g)^2}{E_g(1 - E_g/n_g)}$$

with O_g, E_g and n_g the observed events, expected events and number of observations for the g^{th} risk decile group, and G the number of groups. The test statistic follows a Chi-squared distribution with $G-2$ degrees of freedom.

A large value of Chi-squared (with small p-value < 0.05) indicates poor fit and small Chi-squared values (with larger p-value closer to 1) indicate a good logistic regression model fit (Usman, 2019).

4.0 Material and Methods

The data used in this research is a secondary data obtained from 2015 Nigeria Malaria Indicator survey, executed by the National Malaria Elimination Programme (NMEP) and the National Population Commission (NPopC), with a nationally representative sample of more than 8,000 consisting of 7,745 households. Cross section of all women age 15-49 in these households were eligible for individual interviews. The study considered the following variables (Pregnancy status of the women, Incidence of malaria fever, educational status of the women, income level of the women, women sleeping under treated Net, dwelling sprayed by Government, private company and NGO). These survey data was sourced from World Health Organization website under The Demographic and Health Surveys (DHS) Program.

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The population of the survey of malaria indicator is Nigeria as a whole, for urban and rural areas separately, and for each of the country's six geopolitical zones. The indicator provided for each of the 36 states and the FCT. Nigeria's geopolitical zones are as follows:

North Central: Benue, Kogi, Kwara, Nasarawa, Niger, Plateau, and FCT

North East: Adamawa, Bauchi, Borno,1 Gombe, Taraba, and Yobe

North West: Jigawa, Kaduna, Kano, Katsina, Kebbi, Sokoto, and Zamfara

South East: Abia, Anambra, Ebonyi, Enugu, and Imo

South South: Akwa Ibom, Bayelsa, Cross River, Delta, Edo, and Rivers

South West: Ekiti, Lagos, Ogun, Ondo, Osun, and Oyo

The sample of 7,745 women from the households was used in this study out of 38,442 members in the survey. The survey used cluster sampling and simple random sampling as stated in the Demographic and Health Surveys (DHS) Program of the World Health Organization. The data has been validated by the WHO to have a weighted number of women between the ages of 15-49 as 7,745.

5.0 Data presentation, Analysis and Discussion of Results

5.1 Data Presentations

The data used in this research is a secondary data obtained from the report of 2015 National Demographic Health Survey and the data were presented and analyzed as shown below.

Table 1: Summary Statistic of the socio-economic variables of the Women 15-49 and the dwelling spraying and insecticide treated Net.

Variable	Obs	Mean	Std. Dev.	Min	Max
residence	7,745	1.59122	.4916402	1	2
SPrvt	7,745	.100581	.8817367	0	8

SGovt	7,745	.1101356	.8860033	0	8
SNgo	7,745	.0987734	.8809155	0	8
IncomeLevel	7,745	3.259393	1.352697	1	5
slepNet	7,745	.9610071	.1935905	0	1
PregW	7,745	.1289864	.3352066	0	1
Malfever	7,745	.329632	.4701099	0	1
Education	7,745	2.286637	1.976282	0	8

Where residence is classified as urban and rural; SPrvt is dwelling sprayed by private company; SGovt is dwelling sprayed by government, SNgo is dwelling sprayed by Non-Governmental organization, Income level classified as (poor, poorest, middle, rich and very rich); SlepNet is pregnant women sleeping under insecticide treated Net; Pregnancy status of the women (15-49); Malfever is Malaria fever and Education Level is categorized into, Primary drop out, primary, secondary drop out, secondary and higher education.

Table 2: Classification of the Variables in the Study

Variables	Classification			
Residence	type of place of residence	Freq.	Percent	Cum.
	urban	3,166	40.88	40.88
	rural	4,579	59.12	100.00
	Total	7,745	100.00	
Spray by Government	dwelling sprayed by: government worker/program	Freq.	Percent	Cum.
	no	7,557	97.57	97.57
	yes	93	1.20	98.77
	don't know	95	1.23	100.00
	Total	7,745	100.00	
Spray by Private Company	dwelling sprayed by: private company	Freq.	Percent	Cum.
	no	7,631	98.53	98.53
	yes	19	0.25	98.77
	don't know	95	1.23	100.00
	Total	7,745	100.00	

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Variable	Category	Freq.	Percent	Cum.
Spray by NGOs	dwelling sprayed by: ngo	Freq.	Percent	Cum.
	no	7,645	98.71	98.71
	yes	5	0.06	98.77
	don't know	95	1.23	100.00
	Total	7,745	100.00	
Sleeping under treated Net	slept last night	Freq.	Percent	Cum.
	no	302	3.90	3.90
	yes	7,443	96.10	100.00
	Total	7,745	100.00	
Household Income Level	wealth index	Freq.	Percent	Cum.
	poorest	1,058	13.66	13.66
	poorer	1,351	17.44	31.10
	middle	1,676	21.64	52.74
	richer	1,844	23.81	76.55
	richest	1,816	23.45	100.00
	Total	7,745	100.00	
Educational level of respondents	educational attainment	Freq.	Percent	Cum.
	no education	2,645	34.15	34.15
	incomplete primary	421	5.44	39.59
	complete primary	1,107	14.29	53.88
	incomplete secondary	631	8.15	62.03
	complete secondary	1,622	20.94	82.97
	higher	1,286	16.60	99.57
	don't know	33	0.43	100.00
	Total	7,745	100.00	
Pregnancy Status	PregW	Freq.	Percent	Cum.
	Not pregnant	6,746	87.10	87.10
	pregnant	999	12.90	100.00
	Total	7,745	100.00	
Malaria Fever Cases	Malfever	Freq.	Percent	Cum.
	No fever	5,192	67.04	67.04
	Had fever	2,553	32.96	100.00
	Total	7,745	100.00	

The table 2 above shows the location of residence of the respondents. A total of 7,745 household were visited and 3,166 of them dwell in the urban area while a total of 4,579 household reside in the rural area. Also shows that 40.88% dwell in the urban settlement while about 59.12% dwell in the rural area. The table above also shows the number of households sprayed by the Government. Of the 7,745 households visited, only 93 household was sprayed by the Government, making a total of 1.2% while about 98.5% of the household was not sprayed by the Government. The above table also shows the number of households privately sprayed. Out of the 7,745 households visited 19 of them were privately sprayed, making a total of only 0.25%. The table further shows the number of households who slept under mosquito treated net the night before the visitation. Of a total of 7,745 respondents, 96.10% slept under treated net while 3.90% slept outside treated nets.

The table also shows the income level of the households visited. Out of the 7,745 households visited, 13.66% are categorized as the poorest, 17.44% as poorer, 21.64%as the middle, 23.81% as richer while 23.45% are categorized as the richest

The table also shows the educational level of the respondents. Out of the 7745 respondents, 34.15% of them have no formal Education, 5.44% have incomplete primary education,14.29% have complete primary education,8.15%have incomplete secondary education,20.94 have complete secondary education while 16.60% have higher education.

The Pregnancy Status of the women revealed that 6,746 (87.10%)of the women were not pregnant while 999 (12.90%) of the women were pregnant. The malaria incidence among the women revealed that 5,192 (67.04%) had no malaria fever while 2,553 (32.96%) had no case of malaria fever.

5.2 Data Analysis and Interpretations

To carry out the logistic regression some of the variables were recoded as follows: No and don't know responses were recoded as No; poor and poorest was recoded as Poor; richer and richest

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was recoded as rich; no education and incomplete primary school was recoded as no formal education; complete primary and incomplete secondary school as primary education.

Table 3: Logistic Regression for Malaria Fever

Logistic regression				Number of obs	=	7,745
				LR chi2(11)	=	82.56
				Prob > chi2	=	0.0000
Log likelihood = -4868.414				Pseudo R2	=	0.0084

Malfever	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
SGovt	.3663258	.2104911	1.74	0.082	-.0462291	.7788808
SPrvt	-1.402239	.6048065	-2.32	0.020	-2.587638	-.21684
SNgo	1.035998	.6096231	1.70	0.089	-.1588411	2.230838
slepNet	.113299	.1291469	0.88	0.380	-.1398243	.3664223
PregW	.0320619	.0723047	0.44	0.657	-.1096527	.1737765
Mincome	.2180237	.0685222	3.18	0.001	.0837227	.3523247
Hincome	.0635766	.071507	0.89	0.374	-.0765746	.2037277
Hedu	-.248593	.0792037	-3.14	0.002	-.4038294	-.0933567
Sedu	-.2168482	.0695828	-3.12	0.002	-.3532279	-.0804685
Pedu	.0670928	.0726041	0.92	0.355	-.0752087	.2093943
res	-.2535371	.0584391	-4.34	0.000	-.3680757	-.1389986
_cons	-.7300098	.1340272	-5.45	0.000	-.9926983	-.4673213

Table 4 above considered possible factors that can reduce malaria fever among pregnant women. Spray by private company significant reduce malaria fever among pregnant women (p-value=0.020<0.05). The pregnancy status of a woman can lead to malaria fever, although not significant (p-value=0.657>0.05). Also women with atleast secondary school level are less likely to be inflicted by malaria fever when compared with women with no formal education (p-values=0.002<0.05). Lastly women living in urban centers are less likely to be affected by malaria when compared with women living in rural communities in Nigeria. The results revealed that spray by government, by NGOs and utilization of insecticide treat net does not significantly reduce malaria fever among pregnant women in Nigeria. Following that, the income level of the household does not significantly reduce malaria fever among pregnant women in Nigeria.

Table 5: Logistic Regression for Malaria Fever with robust standard error

Logistic regression — Number of obs = 7,745; Wald chi2(11) = 81.83; Prob > chi2 = 0.0000; Pseudo R2 = 0.0084

Log pseudolikelihood = -4868.414

Malfever	Coef.	Robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
SGovt	.3663258	.2084165	1.76	0.079	-.042163	.7748147
SPrvt	-1.402239	.5423695	-2.59	0.010	-2.465264	-.3392141
SNgo	1.035998	.5568074	1.86	0.063	-.0553242	2.127321
slepNet	.113299	.1291807	0.88	0.380	-.1398905	.3664885
PregW	.0320619	.0724528	0.44	0.658	-.1099429	.1740667
Mincome	.2180237	.0685056	3.18	0.001	.0837551	.3522923
Hincome	.0635766	.0717619	0.89	0.376	-.0770743	.2042274
Hedu	-.248593	.0794907	-3.13	0.002	-.4043919	-.0927942
Sedu	-.2168482	.069575	-3.12	0.002	-.3532127	-.0804837
Pedu	.0670928	.072534	0.92	0.355	-.0750712	.2092568
res	-.2535371	.0587937	-4.31	0.000	-.3687706	-.1383037
_cons	-.7300098	.1340645	-5.45	0.000	-.9927713	-.4672483

Table 5 above presents the result of the logistic regression model for malaria fever using robust standard errors to obtain robust estimates. The table considered possible factors that can reduce malaria fever among pregnant women. Spray by private company significant reduce malaria fever among pregnant women (p-value=0.010<0.05). The pregnancy status of a woman can lead to malaria fever, although not significant (p-value=0.658>0.05). Also women with atleast secondary school level are less likely to be inflicted by malaria fever when compared with women with no formal education (p-values=0.002<0.05). Lastly women living in urban centers are less likely to be affected by malaria when compared with women living in rural communities in Nigeria (p-value=0.000<0.05). The results revealed that spray by government, by NGOs and utilization of insecticide treat net does not significantly reduce malaria fever among pregnant women in Nigeria. Following that, the income level of the household does not significantly reduce malaria fever among pregnant women in Nigeria.

Table 6: Logistic Regression for Malaria Fever with odds Ratio

Logistic regression — Number of obs = 7,745; LR chi2(11) = 82.56; Prob > chi2 = 0.0000

Log likelihood = -4868.414 Pseudo R2 = 0.0084

Malfever	Odds Ratio	Std. Err.	z	P>|z|	[95% Conf.	Interval]
SGovt	1.442425	.3036176	1.74	0.082	.9548232	2.179032
SPrvt	.2460455	.1488099	-2.32	0.020	.0751975	.8050588
SNgo	2.817918	1.717868	1.70	0.089	.8531319	9.30766
slepNet	1.119967	.1446403	0.88	0.380	.869511	1.442564
PregW	1.032581	.0746605	0.44	0.657	.8961453	1.18979
Mincome	1.243616	.0852153	3.18	0.001	1.087327	1.42237
Hincome	1.065641	.0762008	0.89	0.374	.9262838	1.225964
Hedu	.7798973	.0617707	-3.14	0.002	.667758	.9108685
Sedu	.8050522	.0560177	-3.12	0.002	.7024171	.922684
Pedu	1.069395	.0776425	0.92	0.355	.9275499	1.232931
res	.7760509	.0453517	-4.34	0.000	.6920648	.8702293
_cons	.4819043	.0645883	-5.45	0.000	.3705754	.6266787

Table 6 above presents the result of the logistic regression model for malaria fever using odds ratio. The table considered possible factors that can reduce malaria fever among pregnant women. Households with dwelling Spray by private company are 75.4% less like to be affected by malaria fever compared to household that used spray by government and NGOs with those using treated net. This means that spray by private company can significant reduce malaria fever among pregnant women (p-value=0.010<0.05). pregnant women are 3% more likely to have malaria fever compared to women that are not pregnant, although not significant (p-value=0.658>0.05). Also women with secondary school level and higher education are 23% and 20% respectively less likely to be inflicted by malaria fever when compared with women with no formal education (p-values=0.002<0.05). Lastly women living in urban centers are 23% less likely to be affected by malaria when compared with women living in rural communities in Nigeria (p-value=0.000<0.05). Furthermore, the results revealed that spray by government, by NGOs and utilization of insecticide treat net does not significantly reduce malaria fever among pregnant women in Nigeria. Following that, the income level of the household does not significantly reduce malaria fever among pregnant women in Nigeria.

Table 7: Classification Test of Logistic Model for Malaria Fever

```
Logistic model for Malfever

              -------- True --------
Classified |         D            ~D  |      Total
-----------+--------------------------+-----------
     +     |         2             3  |          5
     -     |      2551          5189  |       7740
-----------+--------------------------+-----------
   Total   |      2553          5192  |       7745

Classified + if predicted Pr(D) >= .5
True D defined as Malfever != 0
--------------------------------------------------
Sensitivity                     Pr( +| D)    0.08%
Specificity                     Pr( -|~D)   99.94%
Positive predictive value       Pr( D| +)   40.00%
Negative predictive value       Pr(~D| -)   67.04%
--------------------------------------------------
False + rate for true ~D        Pr( +|~D)    0.06%
False - rate for true D         Pr( -| D)   99.92%
False + rate for classified +   Pr(~D| +)   60.00%
False - rate for classified -   Pr( D| -)   32.96%
--------------------------------------------------
Correctly classified                        67.02%
--------------------------------------------------
```

Table 7 conducted the Classification Test of Logistic Model for Malaria Fever which revealed 67.02% level of correct classification of the malaria fever meaning the level of agreement is high and this is supported by the ROC curve in figure 1 below. In addition to this result, the goodness-of-fit test using the Pearson and Hosmer-Lemeshow shows malaria fever follows a logistic distribution and model (see result in Table 8 below).

Table 8: Goodness-of-Fit Test of Logistic Model for Malaria Fever

```
Logistic model for Malfever, goodness-of-fit test

       number of observations =      7745
 number of covariate patterns =       152
             Pearson chi2(140) =       146.69
                   Prob > chi2 =         0.3325

. estat gof, group(10)

Logistic model for Malfever, goodness-of-fit test

  (Table collapsed on quantiles of estimated probabilities)
  (There are only 9 distinct quantiles because of ties)

       number of observations =      7745
             number of groups =         9
      Hosmer-Lemeshow chi2(7) =         3.22
                   Prob > chi2 =         0.8640
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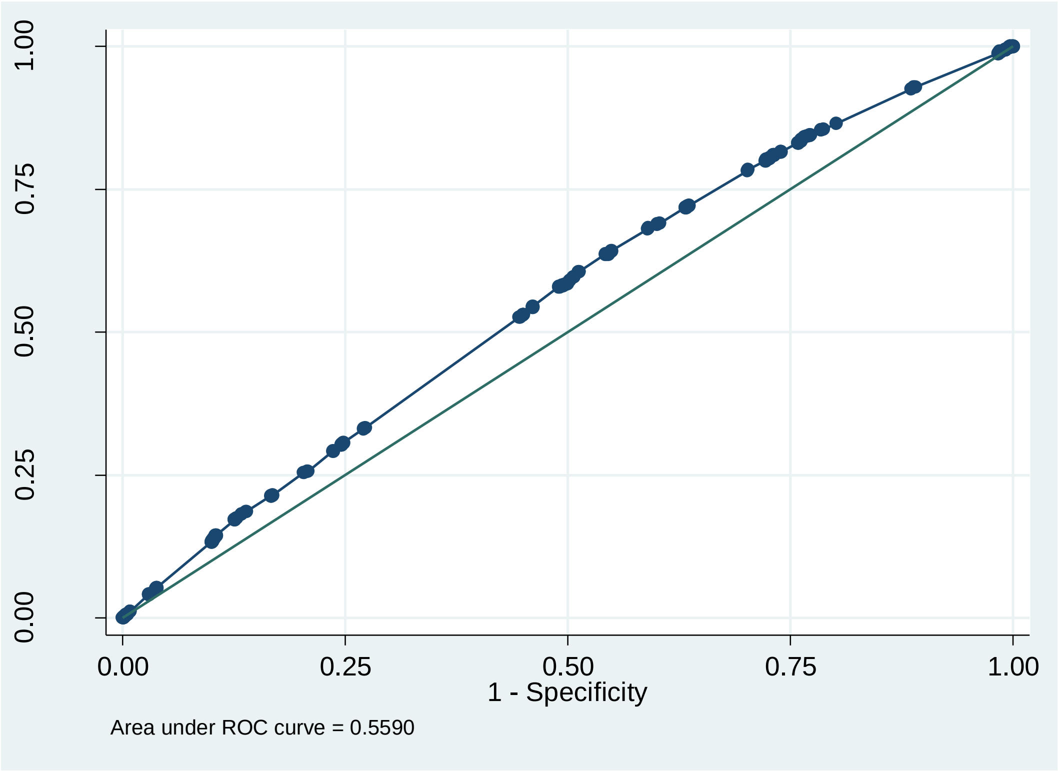

Fig. 1: Area under ROC Curve of Logistic model for Malaria fever

5.3 Discussion of Results

The table 2 above shows the location of residence of the respondents. A total of 7,745 household were visited and 3,166 of them dwell in the urban area while a total of 4,579 household reside in the rural area. Also shows that 40.88% dwell in the Urban settlement while about 59.12% dwell in the Rural area. The table above also shows the number of households sprayed by the Government. Of the 7,745 households visited, only 93 household was sprayed by the Government, making a total of 1.2% while about 98.5% of the household was not sprayed by the Government. The above table also shows the number of households privately sprayed. Out of the 7,745 households visited 19 of them were privately sprayed, making a total of only 0.25%. The table further shows the number of households who slept under mosquito treated net the night before the visitation. The implication of this result is that dwelling spray is greatly under-utilized in Nigeria (NMCP, 2011). Out of a total of 7,745 respondents, 96.10% slept under treated net while 3.90% slept outside treated nets (MIS, 2015). The table also shows the income level of the households visited. Out of the 7,745 households visited, 13.66% are categorized as the poorest, 17.44% as poorer, 21.64%as the middle, 23.81% as richer while 23.45% are categorized as the richest. The table also shows the educational level of the respondents. Out of the 7745 respondents, 34.15% of them have no formal Education, 5.44% have incomplete primary education,14.29% have complete primary education,8.15%have incomplete secondary education,20.94 have complete secondary education while 16.60% have higher education.

The Pregnancy Status of the women revealed that 6,746 (87.10%) of the women were not pregnant while 999 (12.90%) of the women were pregnant. The malaria incidence among the women revealed that 5,192 (67.04%) had no malaria fever while 2,553 (32.96%) had no case of malaria fever. The incidence of malaria among women in Nigeria is high which is similar to the result obtained in Ethiopia (Tegegne et al., 2019).

Table 6 above presents the result of the logistic regression model for malaria fever using odds ratio. The table considered possible factors that can reduce malaria fever among pregnant women. Households with dwelling Spray by private company are 75.4% less like to be affected by malaria fever compared to household that used spray by government and NGOs with those using treated net. This means that spray by private company can significant reduce malaria fever among pregnant women (p-value=0.010<0.05). pregnant women are 3% more likely to have malaria fever compared to women that are not pregnant, although not significant (p-value=0.658>0.05). This result is similar to the results obtained in the workS of Aliyu, et al., (2017) and Agomo et al., (2009). Also women with secondary school level and higher education are 23% and 20% respectively less likely to be inflicted by malaria fever when compared with women with no formal education (p-values=0.002<0.05). Lastly women living in urban centers are 23% less likely to be affected by malaria when compared with women living in rural communities in Nigeria (p-value=0.000<0.05). Furthermore, the results revealed that spray by government, by NGOs and utilization of insecticide treat net does not significantly reduce malaria fever among pregnant women in Nigeria. Following that, the income level of the household does not significantly reduce malaria fever among pregnant women in Nigeria.

Table 7 conducted the Classification Test of Logistic Model for Malaria Fever which revealed 67.02% level of correct classification of the malaria fever meaning the level of agreement is high and this is supported by the ROC curve in figure 1. In addition to this result, the goodness-of-fit test using the Pearson and Hosmer-Lemeshow shows malaria fever follows a logistic distribution and model (see result in Table 8 above).

6.0 Conclusion and Recommendations

Households with dwelling Spray by private company are 75.4% less like to be affected by malaria fever compared to household that used spray by government and NGOs with those using treated net. This means that spray by private company can significant reduce malaria fever among pregnant women (p-value=0.010<0.05). Pregnant women are 3% more likely to have malaria fever compared to women that are not pregnant, although not significant (p-value=0.658>0.05). Also women with secondary school level and higher education are 23% and 20% respectively less likely to be inflicted by malaria fever when compared with women with no formal education (p-values=0.002<0.05). Lastly women living in urban centers are 23% less likely to be affected by malaria when compared with women living in rural communities in Nigeria (p-value=0.000<0.05). Furthermore, the results revealed that spray by government, by NGOs and utilization of insecticide treat net does not significantly reduce malaria fever among

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pregnant women in Nigeria. Following that, the income level of the household does not significantly reduce malaria fever among pregnant women in Nigeria. While the Classification Test of Logistic Model for Malaria Fever which revealed 67.02% level of correct classification of the malaria fever meaning the level of agreement is high and this is supported by the ROC curve in. In addition to this result, the goodness-of-fit test using the Pearson and Hosmer-Lemeshow shows malaria fever follows a logistic distribution and model.

Based on the findings from this study, the following are recommended:

- **i.** Dwelling spray by government and NGOs should be intensified to reduce malaria among women in Nigeria.
- **ii.** Girl child education should be encouraged as this could help them to obtain knowledge that can help them to reduce malaria fever in their home.
- **iii.** More Malaria prevention measures should be geared toward women in rural communities of Nigeria.
- **iv.** Awareness campaign on the danger of malaria should be intensified and effectiveness in the distribution of treated net across Nigeria should be given priority.

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