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Socio-Economic Factors and Prevalence of Anemia and Malaria among Nigerian Children

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Abstract:
This paper uses data from the Nigerian Malaria Indicator Survey (2015) to analyze the parent's socioeconomic determinants of anaemia and malaria infection among Nigerian children. The major objective of the study is to determine the prevalence of anaemia and malaria infection among children from different socioeconomic households. Using probit regression analysis, this study found statistically significant and negative correlation between household wealth index, mother's education, place of residence and prevalence of anaemia and malaria infection, the estimates are robust to inclusion of different covariates. Age, gender and region were also found to be important determinants of prevalence of these diseases in children. Intervention programmes, targeting location of well-equipped healthcare centres in the rural areas and health insurance for-all, should be put in placeby government, while programmes that will increase the income of the poor should be prioritized.

Keywords: *Anaemia, malaria, socioeconomic status, household income, programmes, child diseases and nutrition*

1. Introduction

Anemia and malaria infection are the major children's diseases and the causes of child mortality in Sub-Saharan Africa, and particularly in Nigeria. Benoist, Mclean and Cogswell (2008) reported that among the estimated 293.1 million under five children in the world that suffered from anemia, 28.5% are from Sub-Sahara Africa. While 216 million cases of malaria occurred worldwide in 2016, resulting in additional 5 million cases from the 2015 figure,90% of which occurred in Africa, Nigeria accounted for the highest proportion worldwide (WHO, 2017). The document further states that out of the 446,000 deaths resulting from malariaglobally in 2016, Nigeria, Democratic republic of Congo, Burkina Faso and India share 58% of the total death worldwide.

Anemia is considered the result of either insufficient or faulty red cells to take oxygen to tissues and organs in the body, it is measured in the blood by the level of hemoglobin (HB) (NHS, 2010). The clinical causes of anemia ranges from inadequate iron in the body resulting from malnutrition to effect of infectious diseases like tuberculosis, HIV, malaria and helminthic. Anemia not only increases the rate of child mortality, but also makes children to live permanently below their level of physical and mental potential. As noted in Sanou and Ngnie-Teta (2009), health effect of anemia disease in children (especially under 5) includes: impaired psyco-motor development and growth, altered cognitive function, poor school performance, poor immune function and susceptibility to infectious and decreased responsiveness and activity.

Malaria is also an important disease in children manifesting in various disease forms. Its clinical cause in Nigeria is malaria parasite (Plasmodium falciparum). Murphy and Breman (2001) stated that acute malaria infection can lead to cerebral malaria (cm), anemia and respiratory distress, and can sometimes have long-term neurological consequences in children.

The focus of this study is to move away from the clinical causes of anemia and malaria in children, and focus on the prevalence of these diseases among different socioeconomic groups. The prevalence of anemia and malaria infection is associated with education, income, occupational rank and ethnicity/region, as revealed by studies from Kenya, Ghana and Nigeria. For instance, Gayawa, Ekundayo and Samson (2014)found that socioeconomic status, measured by household income and household assets, is a key determinants of anemia in children. The reason being that household of low socioeconomic status can hardly afford three meal a day, and where they do, the food content is usually poor in nutrient, and also live in a poorly sanitized environment that can cause diseases.

Results from other studies found region, in terms of rural/urban disparity, to play an important role in determiningthe prevalence of anemia and malaria infection in children. Residing in the rural area increases the rate of child malnutrition, anemia and malaria infection (Oladeinde, Omoregie, Anunibe, Onifade&Oladeinde (2012); Bentley 2003 &Ngnie-Teta 2007). They argued that rural dwellers are not only characterized with low income and low education leading to poor

nutrition intake, they live in an environment with poor sanitation, characterized with pockets of stagnant waters and bushes serving as niche to larva proliferation increasing the incident of malaria and anemia. Ngnie-Tete and Soun (2012) further stated the variability in the risk of anemia is attributable to the differences between communities, regardless of individual and household characteristics.

Parents' education, as a component of socioeconomic status, also constitutesan important determinant of anemia in children. Educated parents have better knowledge of nutrition and are more likely to afford healthier dietary habit due to high income earned from well paid jobs. It means therefore that higher level of education in parents reduces the incidence of nutritional anemia in children(Osorio, Lira & Ashword 2004).The level of education is also found to be an important determinant of malaria prevalence. Sultan, Sheikh, Mahumud, Jahir, Islam and Sarker (2017) found the cases of malaria to be higher among children with less educationand illiterate household head. The medium through which education aids the spread of malaria among parents of different educational levels could be traced to knowledge about preventive measure to malaria infection.

Although, several studies on the incidence of anemia and malaria in children have been undertaken in Ghana, Kenya and Malawi, most of these studies are found in the medical journals with emphasis on the clinical causes and prevention of these diseases. Less emphasis is placed on the prevalence of anemia and malaria among different socioeconomic households. Due to this, and the fact that little is known about the topic in Nigeria, this paper sought to study the socioeconomic determinants of anemia and malaria among children in Nigeria.

2. Literature Review

The prevalence of anemia and malaria among different socioeconomic groups is an important study in most African countries due to high rate of these diseases, and their resultant effects on child mortality in African children. Even though the rate of these diseases among Nigerian children is high, very few studies have been conducted in Nigeria. Therefore, this study sought to bridge the gap by carrying out the study, the review of relevant studies are done below.

Ngesa and Mwambi (2014) studied the prevalence and risk factors of anaemia among children aged between 6 months and 14 years in Kenya. They used generalized linear models in their analysis. They found malaria infection in children to be strongly associated with the risk of anaemia. Many children with anaemia were mostly diagnosed with malaria, this indicate that the prevalence of anaemia can be determined to some proportion by malaria incident. The prevalence of anaemia was found to be higher among children from household categorized to be poorest in the wealth index quartile compared to children from household of the richest quartile. Their result also shows that children whose mothers had post-secondary and higher level of education were less likely to be tested positive anaemia.

A similar and recent study from Kenya is that of Sultana, Sheikh, Mahumud, Jahir, Islam and Sarker (2017). They studied the prevalence and associated determinants of malaria parasites among Kenyan children aged 6 months to 14 years. This findings agree with the above that malaria is strongly associated with aneamia and the prevalence to be lower among children from rich and educated household compare to their poor and uneducated counterparts. But Sultana et al went further to look at the prevalence of malaria and anaemia among children of different age and region. They found the prevalence of malaria to be lower among children of aged 5 and below, but increases with increasing age. Their result also found the risk of malaria infection to be higher among children from rural area than children from the urban area. The argument of lower rate of anaemia and malaria infection among children from educated household in Kenya is from the fact that, educated parents are more informed about protective measures against aneamia and malaria transmitting organisms. Most educated parents can also afford the means to these protective measures and therefor reduced the rate of exposure of their children to the causing mechanisms of these diseases. In terms of income determinants of malaria and anaemia in Kenya, these researchers argue that most poor household in Kenya sleep on the floor and lack the adequate finances to take protective measures against anaemia and malaria.

Nyarko and Cobblah (2014) studied Socio-demographic determinants of malaria among under-five children in Ghana, using 2008 Ghana Demographic and Health Survey Data. Their finding was similar to the finding of Sultana et al (2017) from Kenya in terms of parents' income, region, education and age of children. They also found other important determinants of malaria to include: mothers' age and stable marriages. Nyarko and Cobblah (2014) found the prevalence of malaria to be higher among children born of older mothers and children from single parent households. They opined that prevalence of malaria in children due to age of mothers might be as a result of weak immunity from older mothers due to maternal depletion caused by higher number of births. This low immunity in mothers caused weak immunity to fight malaria infection in children. While, the high incident of malaria among children from single parents was as a result of inability of single parents especially mothers to adequately care and provide protection to their children against malaria.

Ronald, Kenny, Klinkenberg, Okoto, Boakyo, Barnish and Donnelly (2006) used cross-sectional survey to study malaria and anaemia among children in two communities of Kumasi, Ghana. Their result is similar to the findings of Nyarko and Cobblah (2014), in terms of parental income. But differs in terms of region from which the children were given birth to. Even though they found the prevalence of malaria to be higher among children from the rural area of Ashanti and Northern Ghana, the found the prevalence of malaria to also vary widely across city communities. The prevalence of anaemia was also higher for some rural and urban communities. Despite the fact that the study found malaria to be an important determinant of anaemia, this is only particular to the rural areas. Malaria was not an important determinant of anaemia in the cities, but

malnutrition, infectious diseases, helminth and haemoglobinothies. They added that the reason for the unevenly spread of anaemia and malaria in both urban and rural children is housing structure. Ronald et al opined that malaria and other child diseases that may lead to anaemia are not necessarily restricted to region but, whether a child live in a Poor or quality housing structure. Poor quality housing are usually breeding ground to vectors that causes these child diseases.

Some studies from Democratic Republic of Conga agree on the higher prevalence of malaria and anaemia among children from low income household and household from rural areas (Mulumba, Weny, Ngimbi, Pahikuk, Vander &Muynck 1990; Ferrari, Ntuku, Ross, Schuidlin, Kalemwa, Shefu&Lengeler 2016 and Mwandagalirwa, Levitz, Thwai, Parr, Goel, Janko, Tshefu, Emch, Meshnick& Carrel 2017), but differ on the influence of other factors like bed net usage. Mwandalalirwa et al added that the reason for lower prevalence of malaria among higher socioeconomic household is due to the protective nature of their housing (class, screen and electricity) not the physical features of individuals in the household. While, Ferrari et al (2016) and Mulumba (1990), found usage of bed net as important protection against malaria leading to lower prevalence among users, Mwandagalirwa et al (2017) found weak association between malaria infection in children and bed net use.

Studies from Equatorial Guinea and Rwanda shows similar findings to the results of studies in Democratic Republic of Congo, in terms of household income and housing conditions (Ncogo, Romary-Baria, Benito, Aparicio, Nseng, Berzosa, Santana-Morales, Rihoha, Valladares&Herrador, 2017 and Kateera, Ingabire, Hakizimana, Kalinda, Mens, Grobusch, Mutesa&Vugt, 2015). But emphasis child age and parents education as the most important determinant of malaria and anaemia in children. While, Ncogo et al (2017), found increase prevalence of anaemia as children increase in age. Reason be that children might start school with untreated anaemia cases and low nutritional intake. Kateera et al (2017), found increase prevalence of malaria with increasing age, reason be that children at lower ages are more likely to sleep under mosquito treated net compare to their older couterparts. But in contrast found prevalence of anaemia to decrease as children increase in age. These two studies from DR Congo agrees on the importance of age in explaining the prevalence of anaemia and malaria in children, but differs in the direction of the relationship. This might be as a result of data used or community effect in their investigation.

Most studies from Gabon and Gambia revealed a contrary result compare to the above findings. Luckner, Lell, Greve, Lehman, Schmidt-Ott, Matousek, Herich, Scmid, Mba and Kremsner (1998) undertook a study in Gabon on the influence of socioeconomic factors on severe malaria and anaemia infection. Their result revealed no significant influence of socioeconomic factor on the severity of malaria and anaemia diseases in children. They concluded that socioeconomic factors are not important determinants of severe malaria and anaemia in Gabon. Koram, Bennet, Adiamahand Greenwood (1995) who studied socioeconomic determinants of severe malaria in Gambian children also found no association between parents' education and income with their children risk of malaria and anaemia infection. They undertook another study the same year on the socioeconomic risk factors for malaria in a peri-urban area of the Gambia with same result in terms of education and income. But found high prevalence of malaria in the rural area characterized with poor quality housing and crowding compared to urban communities. Another study in the Gambia by Deen and Von (2002) found malnutrition to contribute to malaria associated mortality and severe malaria to be associated with anemia. They opined that adequate nutrition was significant in antibody formation, which explained why chronically malnourished young children were found to have increased risk of consecutive malaria episodes. This result was contrary to a study in Burkinafaso, which showed no relationship between malaria and malnutrition in children (Muller, Konyate&Becher, 2003).

Gayawan,Arogundade and Adebayo (2014) studied the possible determinants and spartial patterns of anaemiaamong young children in Nigeria, using bayesian semi-parametric modelling approach. They found that children residing in the poorest and poorer socioeconomic household were significantly more likely to be anaemic. But found maternal education not to be an important determinants of anaemia in children. In terms of parents education, especially maternal education this studies agree with some findings of Deen and Von (2002) and Koram et al (1995), but disagree to the findings of most studies from Kenya and Ghana who evidenced that parents education are strong determinants of anaemia and malaria Sultana et al (2017); Nyarko and Cobblah (2014) and Ngesa and Mwambi (2014). Gayawan et al (2014), emphasis that the reason why maternal education is not an important determinants of anaemia is due to cultural differences. They opined that, the intake of food with iron-rich components such as weaning foods mostly depends on cultural related behaviours in Nigeria. The deficiency of this iron-rich components mostly leads to anaemia in children. This is because, intense growth of children between 6 months to 2 years result to high demand of iron supplement. Therefore, the effect is more on children of age 6 month to 2 years compared to their older counterparts. They also found the incident of anaemia to be higher in some northern states of Nigeria which is in a way similar to the findings of Oladeinde, Omoregie, Olley, Anunibe, Onifade and Oladeinde (2012). They study malaria and anaemia among children in a low resource setting in Okada Ondo State Nigeria. Their finding emphasis environmental factors as the important determinants of malaria and anaemia in children. They found the prevalence of malaria and anaemia to be at its peak during the raining season in Okada, usually due to stagnant waters.

The two studies undertaking in Nigeria emphasis different factors as the important factors to explain the prevalence of malaria and anaemia in Nigerian children. Gayawan et al (2014) used country level data and found socioeconomic factors in terms of income and region by state to be the important determinants of anaemia. Oladeinde et al (2012) used a community in Ondo State and found environmental factors to be the strongest determinants of malaria and anaemia in children. It is based on this backdrop that this research work seek to use a country level data (NDHS 2015) to reconcile these differences and also to expand on the study of Gayawan et al (2014) by including malaria to child disease in Nigeria.

3. Methods

3.1. Data

This study used data from Nigeria Malaria Indicator Survey (NMIS) 2015 which was collected under the Nigerian Demographic and Health Survey (NDHS). NMIS 2015 was implemented by the National Population Commission (NPC), National Malaria Elimination Programme (NNEP) and the National Bureau of Statistics (NBS) from October through November 2015.

NMIS 2015 is a country level data that covers the 36 states of Nigeria including FCT. The samples from this survey were collected using a two-stage probability sampling. In the sampling selection, nine clusters were selected each from the 36 states of the country including FCT making a total of 33 clusters. Out of the 33 clusters, 138 were in the urban areas while 195 clusters were selected from the rural communities. Six rural clusters from the selected 195 were dropped from Borno State and one from Plateau state due to insecurity in the areas. The survey also selected a total of 8,148 household of which 7,841 were occupied and 7,745b households were successfully interviewed. 8,106 women were selected for interview from the selected household, but 8,034 were available and interviewed.

Three different questionnaires were used to collect data which include: household questionnaire, women questionnaire and Biomaker questionnaire. The women questionnaire collected information from selected women aged 15-49 about their individual characteristics, birth history and child mortality, malaria and aneamia treatment and prevention and also antenatal care. The household questionnaire on the other hand collected information about each individual residing in the household interviewed. Individual specific information to include sex, age, education and relationship to the head of household were collected. Information on household dwelling condition such as: type of toilet facilities, source of drinking water, ownership of durable goods and the use of mosquito were gathered. While, the result for anaemia and malaria testing were recorded in the biomarker questionnaire.

The important variables that will be used for analysis in this paper include: household place of residence (either urban or rural), household wealth index, mothers educational level, age of child, sex of age and whether a child is tested positive or negative of malaria and anaemia. The anaemia test is to indicate if a child has severe anaemia, moderate anaemia, mild aneamia or non anaemic. While the malaria test indicate if a child is positive or negative of malaria. The wealth index categorized household based on their earned income into: poorest, poorer, middle, richer and richest.

3.2. Data Analysis

Probit regression was adopted to analyze parental socioeconomic determinants of malaria and anaemia in children. Malaria and anaemia were used as dependent variables, while parental socioeconomic status, individual characteristics, place of residents and child individual characteristics were used as independent variables. Parental socioeconomic status comprises of parental wealth index, education and place of resident. For each of the dependent variables, two models were estimated: models containing only parental socioeconomic status as covariates, and the full models with the necessary covariates that serves as control variables. These two models for each dependent variables are used to test the robustness of the result.

$CM = \alpha 1 + \beta 1W + \beta 2E + \beta 3R + \beta 4PC + \beta 5CC + \varepsilon$…….. eqn 1

$CA = \alpha 1 + \beta 1W + \beta 2E + \beta 3R + \beta 4PC + \beta 5CC + \varepsilon$ …….. eqn 2

The coefficients on parental socioeconomic status ($W, EandR$) are the main parameters of interest in this study. These coefficients indicate the prevalence of child anaemia and malaria among different socioeconomic groups. CMandCA are dependent variables for malaria and anaemia indicator in children respectively. While $PCandCC$ are parental and children characteristics which serves as control variables.

Variables	Children with Malaria	Children free of malaria	Children that are anemic	Children that are non-anemic
Wealth Index				
Poorest	64	36	81	19
Poorer	61	39	76	24
Middle	47	53	70	30
Richer	29	71	62	28
Richest	14	86	48	52
Variables	**Children with Malaria**	**Children free of malaria**	**Children that are anemic**	**Children that are non-anemic**
Mothers' Education				
Non	57	43	76	24
Primary	44	56	69	31

Secondary	30	70	61	39
Higher	12	88	45	55
Place of Resident				
Urban	24	76	55	45
Rural	54	46	74	26
Child Gender				
Male	45	55	69	31
Female	42	58	66	34
No. of Children Who sleep Under Mosquito Net				
Non	40	60	65	35
Some	52	48	73	27
All	46	54	69	39
Child Malaria Sta.				
Positive			82	18
Negative			56	44
Region				
North West	58	42	81	19
North Central	47	53	64	36
North East	43	57	63	37
South East	32	68	58	42
South	30	70	69	31
South West	33	67	59	41

Table 1: Prevalence of Malaria and Anemia among Different Socioeconomic Status Groups

3.3. Summary Statistics

The summary statistics in table1 shows the raw description of the data in percentages. This explains the raw relationship between Parental socioeconomic status and the incident of malaria and anaemia in children. Parental socioeconomic status in this paper is measured by the household wealth index, mother's education level and place of residence. Table1 shows that, 64%of children from the poorest household tested malaria positive while 36% tested negative compared to only 14% of children from the richest household who tested positive while 86% of those children tested negative. This result is similar in respect to parental place of residence and mother's education. 57% of children from homes where the mother has no formal education were tested positive with malaria, while only 12% of children whose mothers have higher level of education were tested positive with malaria. In respect to place of residence, 54% of children who resides in the rural areas that were tested of malaria were positive while 24% of the children who resides in the urban areas were tested positive having the remaining 76% negative.

The summary statistics also shows that the rate of malaria infection is more among male (45%) children compared to the rate among female children (42). It further shows that the rate of malaria is higher among children in the North Western part of the country compared to any other region in the country.

The raw relationship between parental socioeconomic status and anaemia in children follows similar pattern to that of malaria. Table1 shows that 81% of children from poorest household are anemic compare to only 48% of children from the richest household who are anemic. It also shows that 76% of children with non-formal education motherland 74% of children who reside in the rural areas were tested anemic. While only 45% of children with higher education mothers and 55% of children who reside in the urban areas are anemic. In terms of region, north West has the highest incidence among children (81%) compared to children from any region in Nigeria.

In summary, table1 shows that the prevalence of malaria and malaria are higher among children from lower socioeconomic household.

Model 1 (CM)			Model 2 (CM)	
Child with Malaria (CM)				
Wealth Index				
Poorer	-0.0223	(0.0216)	-0.0094	(0.0225)
Middle	-0.119***	(0.0222)	-0.114***	(0.0235)
Richer	-0.249***	(0.0221)	-0.259***	(0.0238)
Richest	-0.348***	(0.0221)	-0.375***	(0.0227)
Mother's Education				
Primary	-0.042*	(0.0519)	-0.052*	(0.0206)
Secondary	-0.059**	(0.0529)	-0.057*	(0.0219)
Higher	-0.175***	(0.0979)	-0.174***	(0.327)
Place of Residence				
Urban	-0.113***	(0.0482)	-0.136***	(0.0191)
Age of Child			0.0053***	(0.00047)
Male			0.0175	(0.0145)
Region				
N. Central			-0.0333	(0.0231)
N. East			-0.131***	(0.0202)
S. East			-0.0109	(0.0315)
S. South			-0.0505	(0.03017)
S. West			0.0983**	(0.0315)
H. H. age			0.0009	(0.00059)
H. H gender			0.0307	(0.0291)
No. of Children under net				
Some			0.0048	(0.0227)
All			-0.0259	(0.0165)
Cons	0.400***	(0.0418)	-0.109	(0.117)
N adj. R-sq	5295		5277	

Table 2: Influence of Parental Socioeconomic Status on Child Malaria Infection
Standard Errors in Parentheses
** P<0.05, ** P<0.01, *** P<0.001*

Model 7 (CA)			Model 8 (CA)	
Child with Anemia (CA)				
Wealth Index				
Poorer	-0.152*	(0.0618)	-0.0865	(0.0658)
Middle	-0.245***	(0.0660)	-0.0991	(0.0717)
Richer	-0.376***	(0.0727)	-0.181*	(0.0814)
Richest	-0.588***	(0.0845)	-0.363***	(0.0963)
Mother's Education				
Primary	-0.0937	(0.0541)	-0.0590	(0.0580)
Secondary	-0.129*	(0.0535)	-0.161**	(0.0588)
Higher	-0.366***	(0.0822)	-0.311***	(0.0872)
Place of Residence				
Urban	-0.213***	(0.0474)	-0.161**	(0.0516)
Age of Child			-0.0184***	(0.00128)
Male			0.130***	(0.0382)
Region				
N. Central			-0.413***	(0.0641)
N. East			-0.416***	(0.0604)
S. East			-0.269***	(0.0817)
S. South			0.00723	(0.0816)
S. West			-0.227**	(0.0792)
H. H. age			-0.00239	(0.00138)
H. H gender			-0.0208	(0.0748)

	Model 7 (CA)		Model 8 (CA)	
Region				
Child with Malaria			0.694***	(0.0437)
No. of Children under net				
Some			0.0468	(0.0618)
All			-0.0422	(0.0435)
Cons	0.911***	(0.0470)	1.393***	(0.124)
N	5298		5274	
adj. R-sq				

Table 3: Influence of Parental Socioeconomic Status on Child Anaemia Infection
Standard Errors in Parentheses
** P<0.05, ** P<0.01, *** P<0.001*

3.4. Main Result

Table2 and table3 show the probit regression of parental socioeconomic determinants of anaemia and malaria infection in Nigerian children. Table1 presents the result of parental socioeconomic determinants of child malaria infection with model 1 and 2. While, table2 presents the result of parental socioeconomic determinants of child anaemia level with model 3 and 4.

3.5. Malaria Incident in Children

Model1 in table1 shows that holding other variable constant, a change of status of a household from poorest to poorer will make no significant change in the incident of malaria infection in such a household. While, a change of status from poorest to middle income and richest quartile of the wealth index will reduce the incident of malaria from a household by 0.12 and 0.35 percentage point respectively. It also shows that a child whose mother has a higher school attainment is 0.18 percentage point less likely to be infected with malaria compared to a child whose mother has no formal education. The coefficient on urban, indicates that children who reside with their parents in the urban areas are 0.11 percentage point less likely to be infected with malaria compared to children who resides in the rural area. All the coefficients listed are statistically significant at 5% level.

Model 2 was used to check the robustness of model 1 by including all the necessary covariates to serve as control variables. The coefficient on middle wealth index reduced from 0.12 percentage point to 0.11 percentage point and that of richest increased from 0.35 to 0.38 percentage point. This implies that the wealth index of a household is an important predictor of child malaria infection, because even after including control variables there was no significant change in the value of coefficients.Reduction in the coefficient of higher education from 0.18 to 0.17 percentage point shows a small influence of control variables on the effect of mother's educational level on child malaria infection. Another strong predictor of child malaria infection is the place of residence. The coefficient on Urban increased from 0.11 to 0.14 percentage point, which predict that other variables have no effect on place of residence as a factor that determines child malaria infection. These results indicate that the likelihood of malaria incident reduces as household move higher in their socioeconomic status.

Other important variables that determine the prevalence of malaria in children include change age and region. The coefficient on child age indicate that the risk of malaria in children increased with increasing age, while the coefficient on North West shows that the risk of malaria in children is lower in the North East when compared to North West but higher in the South West region of the country.

3.6. Anaemia Incident in Children

Table3 shows the result of model3 and model4. Model3 shows the result of child anaemia infection and parental socioeconomic status as the only covariates. The coefficients on the measures of wealth index signifies that, the differences in the prevalence of anaemia was higher for children from middle income household, richer household and richest household in compared to children from the poorest household. These differences indicated prevalence of anaemia in children decreases steadily with higher wealth index. The result revealed that, there was no differences in the prevalence of anaemia in children from the poorest and poorer households. The coefficients on wealth index that are statistically significant at 5% level include: middle -0.25, richer -0.38 and richest -0.59.

There was also a significant difference in the prevalence of anaemia between children from households where mothers education level are higher degrees (-0.37) compared children from household whose mothers have no formal education. The negative values on higher degree indicated lower incidence of anaemia among children from mothers with higher degrees compared to their counterparts having mothers with no formal education. But there was no significant difference in anaemia prevalence among children whose mothers have either primary, secondary certificate or no formal education. Place of residence was also a strong determinant of anaemia in children. Children who reside in the urban areas 0.21 percentage point less likely to be at risk of anaemia infection compared to children residing in the rural areas.

Model 4 was presented to test the robustness of the result in model 3. Model4 is the preferred specification as it controls for the effect of other variables.Including control variables decreases the estimates on parental socioeconomic status slightly (middle -0.099, richer -0.181, richest -0.36, highest education -0.311 and urban -0.16). The decrease in these coefficients suggest that variables as child age, gender, malaria infection and region are partial determinants of the prevalence of anaemia in children. Model4 result revealed that controlling for other important variables, the only significant difference in the prevalence of anaemia between the poorest household and other wealth index categorization is the richest household. The result also shows that mother's education and place of residence are consistent determinants of the prevalence of anaemia in children.

4. Discussion of Result

This paper studied the parental socioeconomic determinants of anaemia and malaria infection in children. This study is important due to the high incidence of these diseases among children in Nigeria. The result of this paper shows that parental socioeconomic status measured by household wealth index, mother's education and place of residence is significantly and negatively associated with the prevalence of anaemia and malaria in children. This finding agrees with the findings of Ngesa and Mwambi (2014), Sultana et al (2017), Nyarko and Cobblah (2014), Mulumba et al (1990) and Ferari et al (2016).

Despite the importance of wealth index as a determining factor for the prevalence of anaemia and malaria in children, mother's education and place of residence are the strongest and consistent determinants of these diseases as presented by this study. This is a fact, because educated mothers been closest to their children have the knowledge about protective measures against child anaemia and malaria infection. They are also more likely to be employed in a well-paying job giving, giving them the means to adequately care for their children. Place of residence as a determining factor of these diseases can be explain through the nature of housing structure and environmental sanitation and the poor infrastructures in the rural areas compared to urban areas. This finding is in consonance with the studies of Ronald et al (2006) and Oladeinde et al (2012). The opined that the major causes of anaemia and malaria in children are poor housing structure and poor environmental sanitation characterizes with water logging and buses forming a breeding ground to vectors that causes these diseases.

Most studies from Gabon and Gambia found a contrary result in terms of household wealth index and parents' education. For instance, Luckner et al (1998), Koram (1995), Deen and Von (2002) and Muller et al (2003) found household wealth index and parents' education not to be important determinants of malaria and anaemia in children. They found other factors as malnutrition, place of residence, age and mosquito net usageto be the major determinants of the prevalence of anaemia and malaria in children. These finding may be as a result of country specific factors. Gayawan et al (2014), a Nigerian study also found a contrary result with respect to mother's education which they found not to and important determinant of anaemia in children. But emphasis the important of household wealth index and place of residence which agrees to this study. They argued that food intake with poor iron components was the major causes of anaemia and that it was a cultural habit that defile education. This study agrees with some findings from Nigeria, Ghana and Kenya as stated earlier that emphasis the importance of parents education in the prevalence of these child diseases. Parents with higher education are more likely to be informed about nutrition in children and possess the ability to provide same to their children. They will better take precautionary measures to protect their children against anaemia.

Other important determinants of the prevalence of anaemia and malaria in children revealed by this study include child age, child gender and region. The North West and South western region of Nigeria were found to have the highest prevalence of these child diseases. This is probably due to the rate of poverty in these regions. While the risk of malaria infection was found increase with increasing age in children, the risk of anaemia was found to decrease as children grows older. This is in agreement with the finding of Sultana et al (2017), Kateera et al (2017) and Gayawan (2014). The positive relationship between increase in child age and the risk of malaria could be because younger children are more in the protective custody of their parents compare to the older children. While the higher demand of iron-rich food in younger children especially those in the age 6 months to 2 years will explain the incident of anaemia in younger children.Malaria was also found to be an important predictor of anaemia in children as was documented in the work of Ngesa and Mwambi (2014).

6. Conclusion

This study found Household wealth index, mother's education and place of residence to be the major factors determining the prevalence of anaemia and malaria infection in children. Among these factors, mother's education and place of residence are consistently strong predictors of these diseases in children. Other determinants of the two diseases are age, gender, region and malaria for anaemia prevalence. To effectively reduce the incidence of these child diseases in Nigeria, interventions to promote the location of well-equipped healthcare centers in the rural areas should be the provided; compulsory service for health care providers with adequate incentives,infrastructural facilities and affordable housing scheme should be encouraged in the rural areas; social health insurance scheme for-all should be the priority of government, especially through the Nigerian Health Insurance Scheme. Programmes to encourage food security both in the rural and urban areas, through interventions that increase income of the poor, should also be encouraged. Sanitation and cleanness should be encouraged especially at the local government level to reduce quantity of malaria parasites.

7. References

i. Brabin, B. J., Bates, I., Cuevas, L. E., Haan, R. J. De, Ph, D., Phiri, A. I., … Hensbroek, M. B. Van. (2008). Severe Anemia in Malawian Children.
ii. Benoist B, Mclean E, Egil I and Cogswell M (2008), Word-wide prevalece of anaemia, from 1993 to 2005: WHO global data base on anemia. Geneva: World Health Organisation.
iii. Ene-obong, H. (2015). Determinants of health and nutritional status of rural Nigerian women Determinants of Health and Nutritional Status of Rural Nigerian Women, (December 2001).
iv. Eisele, T. P., Larsen, Ã. D., & Steketee, R. W. (2010). Protective efficacy of interventions for preventing malaria mortality in children in Plasmodium falciparum endemic areas, 88–101. http://doi.org/10.1093/ije/dyq026
v. Ehrhardt, S., Burchard, G. D., Mantel, C., Cramer, J. P., Kaiser, S., Kubo, M., … Mockenhaupt, F. P. (2018). Malaria , Anemia , and Malnutrition in African Children — Defining Intervention Priorities, 194(January), 2–8.
vi. Ferrari, G., Ntuku, H. M. T., Ross, A., Schmidlin, S., Kalemwa, D. M., Tshefu, A. K., & Lengeler, C. (2016). Identifying risk factors for Plasmodium infection and anaemia in Kinshasa , Democratic Republic of Congo. Malaria Journal. http://doi.org/10.1186/s12936-016-1412-5
vii. Gayawan, E., Arogundade, E. D., & Adebayo, S. B. (2014). Possible determinants and spatial patterns of anaemia among young children in Nigeria : a Bayesian semi-parametric modelling, (January), 35–45. http://doi.org/10.1093/inthealth/iht034
viii. Murphy, S. C., & Breman, J. G. (2001). GAPS In The Childhood Malaria Burden In Africa : Cerebral Malaria , Neurological Sequelae , Anemia , Respiratory Distress , Hypoglycemia , And Complications Of PREGNANCY, 64, 57–67.
ix. Mwandagalirwa, M. K., Levitz, L., Thwai, K. L., Parr, J. B., Goel, V., Janko, M., … Carrel, M. (2017). Individual and household characteristics of persons with Plasmodium falciparum malaria in sites with varying endemicities in Kinshasa Province , Democratic Republic of the Congo. Malaria Journal, 1–12. http://doi.org/10.1186/s12936-017-2110-7
x. Ncogo, P., Romay-barja, M., Benito, A., Aparicio, P., Nseng, G., Berzosa, P., … Herrador, Z. (2017). Prevalence of anemia and associated factors in children living in urban and rural settings from Bata District , Equatorial Guinea , 2013, 1–14.
xi. Nyarko, S. H., & Cobblah, A. (2014). Sociodemographic Determinants of Malaria among Under-Five Children in Ghana, 2014.
xii. Micronutrientes, L. De. (n.d.). Causas y consecuencias de la deficiencia de hierro Causes and consequences of iron deficiency, 5–14.
xiii. Murphy, S. C., & Breman, J. G. (2001). Gaps In The Childhood Malaria Burden In Africa : Cerebral Malaria , Neurological Sequelae , Anemia , Respiratory Distress , Hypoglycemia , And Complications Of Pregnancy, 64, 57–67.
xiv. Kateera, F., Ingabire, C. M., Hakizimana, E., Kalinda, P., Mens, P. F., Grobusch, M. P., … Vugt, M. Van. (2015). Malaria , anaemia and under - nutrition : three frequently co - existing conditions among preschool children in rural Rwanda. Malaria Journal, 1–11. http://doi.org/10.1186/s12936-015-0973-z
xv. Library, M. (2017). Nigeria - Malaria Indicator Survey 2015, 1–12.
xvi. Oladeinde, B. H., Omoregie, R., Olley, M., Anunibe, J. A., & Onifade, A. A. (2012). Malaria and Anemia among Children in a Low Resource Setting In Nigeria, 7(3), 31–37.
xvii. Osorio, M. M., Lira, P. L. G., & Ashword, A. (2004), Factors associated with Hb concentration in children aged 6-59 months in the state of Pernambacco, Brazil (91) 307-314.
xviii. Priore, S. E. (2011). Social and biological determinants of iron deficiency anemia Determinação social e biológica da anemia ferropriva, 309–320.
xix. Ronald, L. A., Kenny, S. L., Klinkenberg, E., Akoto, A. O., Boakye, I., Barnish, G., & Donnelly, M. J. (2006). Kumasi , Ghana : a cross-sectional survey, 8, 1–8. http://doi.org/10.1186/1475-2875-5-105
xx. Sanou, D., & Ngnie-teta, I. (2009). Risk Factors for Anemia in Preschool Children in Sub-Saharan Africa.
xxi. Sachs, J., & Malaney, P. (2002). The economic and social burden of malaria, 415(February).
xxii. Sultana, M., Sheikh, N., Mahumud, R. A., Jahir, T., & Islam, Z. (2017). Prevalence and associated determinants of malaria parasites among Kenyan children, 1–9. http://doi.org/10.1186/s41182-017-0066-5