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Mother's Socioeconomic Status and Under-Five Malaria Infection in Nasarawa State

Joseph Paul

PhD Economics, Senior lecturer Department of Economics, Federal University of Lafia, Nasarawa State, Nigeria, https://orcid.org/0000-0002-2127-4508

***Correspondence email:** *pajoforreal@gmail.com*.

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Abstract: The main objective of this paper is to contribute to understanding the relationship between a mother's socioeconomic status and child malaria infection in Nasarawa State. This is because Nasarawa State is one of the states with the highest malaria cases in Nigeria, and previous finding from other malaria endemic areas shows different factors influencing child malaria. This study aimed to research the regional determining factors in Nasarawa State, seeing that less of this study is undertaken in the state. During the survey, a multi-stage sampling technique was used to collect data from 477 women with children between 0 and 5. Binary logistic regression was used to analyse this relationship. The results from binary logistic regression without control variables indicated a negative relationship between the mother's socioeconomic status and child malaria infection. Including necessary control variables in the binary logistic regression shows that the mother's level of education is the only mother's socioeconomic variable that is a consistent determinant of child

malaria infection in Nasarawa State. Lafia and Keffi were the best-performing communities in the state for children with malaria-free infection. At the same time, Agyaragu had the highest number of malaria-infected children. The study recommends that Government and community leaders encourage girl child education, especially among rural dwellers of Nasarawa State, through a sensitisation campaign.

Keywords: Income level, Malaria infection, Mother's education, Place of residence, Preventive measures and Under-five children.

Introduction

Malaria infection is the primary cause of morbidity and mortality rate among African children. This is an issue of utmost concern because though it is preventable, under-five children are the most hit by the burden of malaria infection. Despite efforts by governments and health organisations across the world to fight under-five malaria infection, it is unacceptably high in most African countries, especially Nigeria. For instance, there were 247 million malaria cases in 84 endemic countries, Nigeria inclusive, resulting in 617,000 deaths (World Health Organization, 2022). The report added that Nigeria had the highest number of global malaria cases, accounting for 26.6%, resulting in 30% of global malaria deaths. It is also disheartening to note that under-five-age children in Nigeria alone account for 23% of the worldwide malaria rate (National Population Commission (NPC) & ICF, 2018). The within-country disparity shows that the prevalence of under-five malaria infection in Nasarawa State is 29.9%, according to the RDT test. This indicates that more needs to be done to reduce these rates, especially among children in Nigeria and Nasarawa State.

Malaria in under-five children not only causes malaria fever but can also translate to other childhood diseases that can worsen child health status in Nigeria. Murphy and Breman (2001) reported that acute malaria infection could lead to cerebral malaria, anaemia, respiratory distress, and long-term neurological consequences. Malaria infection can also place a financial burden on both individual households and countries at large. The estimated economic loss concerning malaria treatment and prevention and loss of person-hour was about 132 billion nairas yearly. Nigeria also obtained loans totalling 364 million dollars to fund malaria intervention in 13 states between 2020 and 2024. The Office of the Inspector General (2022) report added that Nigeria received the most significant global fund grant of over 1.5 billion US dollars to combat malaria for the 2017-2020 and 2020-2022 funding cycle as the country with global malaria cases.

Another disturbing issue about child malaria infection is that the prevalence is unequally distributed across different socioeconomic groups, regional divides and between rural and urban dwellers. For example, while the prevalence of under-five malaria infection averages 16% in the southern part of Nigeria, it is about 34% in the Northern part of the country. On the other hand, the prevalence of under-five malaria infection was higher among the lowest socioeconomic households. At the same time, 26% of rural children had malaria compared to 11% of urban children in Nigeria (National Malaria Elimination Program et al., 2022). This indicates that parents are an essential

support system in providing curative and preventive health care needs for their children. Providing a sanitised and safe environment free of malaria-causing organisms (mosquitoes) and giving quality care in the event of illness has much to do with parents' socioeconomic status. Several studies have been carried out on the relationship between parent socioeconomic status and child malaria infection in Nigeria, as reviewed in section two of this study. Different socioeconomic factors such as the mother's education level, household income, place of residence and parent's occupation influence child malaria infection. This study looks closely at this relationship in Nasarawa State due to community-level factors affecting the prevalence of child malaria infection.

Research Problem

Despite the continued breakthrough in medicine and the fact that malaria infection is a preventable and treatable disease, the rate of malaria cases among children in malaria is unacceptably high. Report from Office of the Inspector General (2022) and Malaria Indicator Survey (National Malaria Elimination Programme, 2022) Nigeria received the beggest malaria intervention fund and the highest number of treated mosquito bed nets to prevent malaria. Yet, Nigeria remains the country with the highest global malaria cases. National Population Commission (NPC) and ICF (2019) reported that even though Nasarawa State is among the highest North Central States in malaria intervention, it has a 13.6% prevalence of child malaria in Nigeria. Previous studies have reported different results regarding the factors determining child malaria infection. For instance, Oladimeji et al. (2023) reported that the primary determining factor of child malaria infection in Oyo State is mothers' socioeconomic status, while Bassey and Izah (2017) found a place of residence in some parts of Southern Nigeria. This indicates that community-specific factors are responsible for under-five malaria infections in Nigeria. This necessitates the investigation of the social factors responsible for the increase in malaria cases among children in Nasarawa State, Nigeria. This is important because the researcher has not found many studies of this type in Nasarawa State, which constitutes a gap that this study aims to fill. Understanding and tackling these factors will reduce both the financial and health risks for households in Nasarawa State. The mediating factors, such as the mother's perception of preventive mechanisms, are a new dimension that will aid policymakers in targeting the root cause of continued malaria spread. Uncover to increase the spread.

Research Focus

The primary purpose of this study is to analyse the socioeconomic factors, especially mothers', and their role in influencing malaria infection in under-five children. Both interviews and a structured questionnaire will be utilised to obtain relevant information that will help achieve the study's objective.

Research Aim and Questions

The major objective of the study is to examine the effect of a mother's socioeconomic status on child malaria infection in Nasarawa State. The specific objectives are to investigate the relationship between a mother's education and child malaria infection and examine the relationship between a mother's place of residence, income, and child malaria infection.

Literature Review

The empirical literature is reviewed based on the parents' and, specifically, the mothers' socioeconomic factors that influence malaria infection in under-fives. Some factors include educational level, household income, place of residence, occupation and other covariates that determine child malaria infection.

Oladimeji et al. (2023) studied Socioeconomic predictors of the uptake of malaria interventions among pregnant women and mothers of under-five children in Oyo State. Primary data was collected through a questionnaire and analysed using binary logistic regression. The result shows lower utilisation of malaria intervention among mothers from lower socioeconomic households, especially women aged 35 and above, and therefore had children with a higher prevalence of malaria infection. This finding is similar to previous findings by Maigemu and Hassan (2015) and Novignon and Nonvignon (2012). The intuition behind these findings is that higher-income households can afford better and healthier residences and give their children quality care. On the contrary, Ocheje and Dogara (2016) studied prevalent factors affecting children in Dutse General Hospital in Jigawa. They found that wealth/income is not a determinant of malaria infection in children. These could be due to the type of data used or lack of variability due to the sample area.

Dawaki et al. (2016) studied Winning the battle against malaria in Nigeria: Prevalence and risk factors among Hausa communities in Kano. A cross-sectional, community-based study was conducted on 551 respondents from 5 local government areas of Kano State. The study used a logistic regression model for data analysis and found that low household income was positively related to malaria infection in children. A similar result was reported by Abah et al. (2017a), who examined malaria parasitaemia and the socioeconomic status of selected residents of the Emohua community of River State using Chi-Square to analyse information and test results from 200 respondents. Their result also reported the prevalence of malaria infection to be higher in children from poor households compared to children from more affluent families. These two findings above argued that their result was expected because poor households reside in poor environmental conditions and have inadequate precaution, diagnosis and treatment service.

On the other hand, Anjorin et al. (2023) examine Malaria profile and socioeconomic predictors among under-five children: An analysis of 11 Sub-Sahara African countries. Demographic and Health Survey data from 2010 to 2020 was analysed for these countries using binary logistic regression. The study reported that maternal education level was an important determinant of under-five malaria infection in these Sub-Saharan countries with Nigeria inclusive. This result agrees with the findings of Bassey and Izah (2017), Edeme et al. (2015), Gbenga-Epebinu et al. (2023), Iloh et al. (2013), Olukosi et al. (2020). Some of these studies argued that the higher the parent's education, the better their understanding of child healthcare prevention. Education also opens doors for better jobs and income to better care for a child's health needs. Therefore, children of higher educated parents have health care advantages over their counterparts with lower educated parents.

In contrast, Kunihya et al. (2016a) studied the prevalence of malaria infection and anaemia among children attending Federal Medical Centre Yola, Adamawa State. They collected data from

168 out-patient children at the Emergency Paediatric Unit, Federal Medical Centre Yola and used chi-squared for data analysis. The study found no significant relationship between the educational qualification of parents/guardians and malaria infection in children. This finding also agrees with the result of Isiko et al. (2023), who investigated factors associated with the risk of malaria among children: analysis of 2021 Nigeria Malaria Indicator Survey. The study reported that only place of residence and mosquito bed net determine child malaria infection.

Other previous studies also reported a significant relationship between under-five malaria infection and the place of residents. For instance, Morakinyo et al. (2018) studied housing type and risk of malaria among under-five children in Nigeria. Binary logistic regression was used to analyse the Malaria Indicator Survey 2015, and the result shows that the prevalence of malaria infection was higher among children in rural areas than among urban children. This finding also agrees with the report from Abah et al. (2017b), Ashikeni et al. (2013), Bassey and Izah (2017), Edogun et al. (2017), Ehrhardt et al. (2006), Gayawan et al. (2014), Olasehinde et al. (2010), Oluwasogo et al. (2016), and De Silva and Marshal (2012). One explanation that is common among these findings is that the rural areas are characterised by houses surrounded by bushes and stagnant waters that form habitation to malaria parasites, which can easily affect under-five children. However, a contrary result was reported by Kunihya et al. (2016b), who studied the prevalence of malaria infection and anaemia among children attending Federal Medical Centre Yola, Adamawa State. The study shows a higher prevalence of malaria infection in the urban area of Yola than in its rural surroundings. This could be due to community-level differentials or the type of sample collected, which was from a particular hospital.

Kunihya et al. (2016a) and Kunihya et al. (2016b) both studied prevalence of malaria infection among children in specialist hospital and Federal medical centre Yiola also reported negative relationship between parents' occupational status and malaria infection in children. These studies explain why this relationship depends on parents' knowledge about control measures or higher income that comes with higher jobs, enabling parents to afford quality care for their children. This is because parents in professional jobs usually acquire more education than in manual jobs. Therefore, parents with professional jobs will ordinarily have broader knowledge, including protective measures against malaria infection and income to develop such measures. On the other hand, children whose parents had manual jobs will be more at risk of malaria infection compared to children whose parents had professional jobs.

Contrary, Edogun et al. (2018) studied the prevalence of malaria parasitaemia in three selected Local Government Areas of Niger State. They found no relationship between the occupation of parents and malaria infection in children. This result agrees with the findings of Gbenga-Epebinu et al. (2023). The deviation in this finding could result from categorising parents' jobs. The job categorisation used includes fishermen, cattle-rearers, students and full-time homemakers. These jobs mainly consist of individuals with low or no educational background or can be categorised under manual jobs. Therefore, no significant difference in characteristics might be found. The present study does not include occupation as a socioeconomic status factor because occupation is a product of education and signifies income level.

Some previous studies also reported other factors that influence malaria infection. For instance, Abah et al. (2017b), Bayode and Siegmund (2022), and Dawaki et al. (2016) also reported a lower prevalence of malaria infection among under-five children who use treated mosquito bed nets. On the contrary, Oladeinde et al. (2012) studied malaria and anemia among children in a low resource setting in Okada, Edo State, and De Silva and Marshall (2012) also studied factors contributing to urban malaria transmission in Sub-Saharan Africa: A systematic review found no significant relationship between the use of mosquito bed net and malaria infection. Ashikeni et al. (2013) further found a positive relationship between the use of mosquito bed nets and malaria infection. The intuition behind these findings is that most rural dwellers spend more time outside, where mosquitoes are put on the net only while sleeping. Others have the net but do not use it in the hot season, as it contributes to more heat. Ogomaka and Obeagu (2019) studied the method of breastfeeding as a determinant of malaria infections among babies in Imo State using primary data collected by questionnaire and was analysed using the chi-square method. They reported that children who are exclusively breastfed had a lower prevalence of malaria infection than their counterparts who were not exclusively breastfed; their result agrees with the finding of Fewtrell et al. (2011). On the other hand, Edogun et al. (2017) studied the prevalence of malaria parasitaemia in three selected Local Government Areas of Niger State. They reported housing structure to be an essential determinant of under-five malaria infection in Niger State. This finding is similar to the report by Anyanwu et al. (2017). Children of younger mothers were also found to have higher prevalence of malaria infection. While Iloh et al. (2018) reported a negative relationship between marital status and child malaria infection, Mbachi et al. (2020) found no relationship between the two variables.

The reviewed studies have reported different findings regarding the factors influencing child malaria infection. For example, Oladimeji et al. (2023) reported that the primary determining factor of child malaria infection in Oyo State is mothers' socioeconomic status; Kunihya et al. (2016a) report parental income and occupation as major determinant of child malaria infection in Yola; Bassey and Izah (2017) found a place of residence at some part of Sourthern Nigeria, while, Oladeinde et al. (2012) reported the use of mosquito bed net as major determinants of child malaria infection in some rural communities in Nigeria. This shows that different factors are responsible for under-five malaria infection in different communities of Nigeria. This means that specific factors might determine under-five malaria infection in Nasarawa State. This study aimed to uncover Nasarawa State-specific factors that influence child malaria infection. This filing this gap will aid policymakers in effectively combating child malaria infection in the State.

Research Methodology

General Background

This study employs a cross-sectional design. The cross-sectional design is ideal for this study because it seeks to measure the differences between the groups of people at a particular point (Setia, 2016). The sample size was also selected based on existing differences in the target population. A multistage sampling method was used for the sampling procedure, while a structured

questionnaire was used to gather information from respondents. Binary logistic regression was used to analysed the data collected for the study.

Sample

480 mothers with children between 0 and 5 were drawn systematically from six Local Government areas of Nasarawa State, two from each senatorial zone. A probability sampling technique was used to gather data from these six local government areas. Two hospitals were selected from each of these LGAs, one a public hospital and the other a private hospital. Probability sampling allows all respondents the chance to be selected for information gathering. Information collected from respondents includes parents' socioeconomic status, demographic factors, children's individual characteristics, health indicators, and other important factors.

This study was carried out in Nasarawa State, one of the six states in the North Central geopolitical zone of the country, loosely known as the Middle Belt. Nasarawa State was created on 1st October 1996, located at coordinates 8o32'N 8o18'E, has a total land area of 27,117 and a population of 1,869,377 according to the 2006 census (Population Council, 2007; United Nations Development Programme, 2018). The National Population Report further segmented the population into gender (943,801 males and 925,576 females) and age groups, which consist of 0-14 years (856,004, 45.8%), 15-64 years (961,134, 51.4%) and 65+ years (52,239, 2.8%).

A total number of 108,064 children were registered in the civil register by government authorities in Nasarawa State in 2016, among which 57.58% were children below the age of 5 (National Bureau of Statistics, 2017). This figure might not represent the total number of children below age 5, because of the possibility of some pregnant mothers giving birth at home and might not be included in the civil birth register of Nasarawa State. The population distribution of Nasarawa State according to age is presented at 9 years, and the total population of children aged 0-9 from the 2006 Census stands at 642,572 (Population Council, 2007). It is, therefore, appropriate to use a standard formula to determine the sample size since the actual population figure is not feasible. A minimum sample size can be calculated using:

$$n = \frac{z^2 pq}{d^2} \quad (1)$$

Where n = minimum sample size

z = the standard statistics that define the confidence level desired = 1.96

p = the proportion of people in the study, accounted for by the target population = 57.58/100 = 0.58

57.58 is the percentage of under-fives in the total births reported in Nasarawa State.

q = 1 – p = 1 – 0.58 = 0.42

d = statistic degree of accuracy desired = 0.05

$$n = 1.96^2 \times 0.58 \times 0.42 / 0.05^2 = 374.3255$$

$$n = 374$$

10% of the calculated sample size (37.4) was added to the sample size to make up a total sample size of 411. This is done to take care of possible non-responses during data collection. The degree of non-response in data collection varies according to countries, 10% is typical for most developing countries (Department of Economic and Social Affairs, 2015). Another important viewpoint is that a sample of 10-30% adequately represents the target population in a small survey (Babbie, 1992). While a sample of 30% and above sufficiently represents the target population in a large survey (Mugenda & Mugenda, 1999). Sample size selection criteria allow for flexibility in sample size selection as long as the minimum acceptable size is maintained. This study, therefore, proposed a total sample size of 480 respondents for convenience across the three senatorial districts of Nasarawa State. The sample size selected is also within the range of 400, as is usually determined by the Yemini formula for sample size determination.

Instrument and Procedures

Data was collected from respondents using structured questionnaire instruments from those sampled through multi-stage sampling. The questionnaire, which was divided into three sections, asked three categories of questions. Section A contains information about the mother, including demographic and socioeconomic status; Section B contains information about the child's individual characteristics; and Section C contains information about the child's malaria infection and environmental factors. The information gathered from the questionnaire was modelled into the variables below (Table 1).

Table 1

Variable Definition and Coding (Independent Variables)

Variables	Description	Coding
	Social Factors	
Mother's Education	The highest educational level attained by a mother	Mother with no formal education is coded 0, Primary certificate = 1 Secondary certificate = 2 Diploma, NCE or equivalent = 3 while degree and above = 4
Parent's income	How much a parent earns a month	N25,000 and below = 0 N26,000-51,000 = 1 N52,000-75,000 = 2 N76,000-100,000 = 3 N101,000 and above = 4
Parent's occupation	Occupation status of parent	Non-working parent = 0 Manual labour = 1 Sales/agriculturist = 2 Civil servant = 3 Private servant = 4 Management position = 5

Place of residence	Whether a parent resides in an urban or rural area of Nasarawa State	Rural = 0 Urban = 1
	Demographic Factors	
Age of a child	Age of a child in years at the time of the survey	Age 1 and below = 0 Age 2 =1, age 3 = 2, age 4 = 3, and age 5 = 4
Sex of a child	Gender of a child	Female = 0, Male = 1
Maternal marital status	Mother is married, divorced, or single – had child out of wedlock	Married = 0 Divorce = 1 Single = 2
Ethnicity	Parent ethnic affiliation	Eggon=7, Agatu=6, Alago=5, Tiv=4, Mada=3, Gbagyi=2, Gwandara=1, and others=0
Religion	Parent religious believe	Islam = 0 Christianity = 1 Traditionalist = 2 Other religious 3

Source: Author's compilation 2023.

The dependent variable is child malaria status, coded yes if a child had malaria infection two weeks before the study and no if the child had no malaria fever two weeks before the survey.

Data Analysis

Data was analysed using both bivariate and multivariate logistic regression. This was used to test the robustness of the regression analysis. The bivariate logistic regression analyses the relationship between child malaria status and the mother's socioeconomic variables. The multivariate regression on the other hand, was used to analyse child malaria status and mother's socioeconomic status including all the necessary covariates as control variables. The differences observed between the results of the bivariate regression and multivariate regression which was interpreted, and logical conclusions were drawn for the study. The multivariate logistic regression produced the relationship between child malaria status and the mother's socioeconomic status at a 5% significance level. The binary logistic model assumes a general function G, which takes values between 0 and 1. This is to ensure that estimated probabilities of the independent variables lie within the range of 0 and 1, as is shown below:

$$P\left(y = \frac{1}{\boldsymbol{x}}\right) = G(\beta_0 + \beta_1 X_1 + \cdots + \beta_{\mathrm{k}} X_{\mathrm{k}}) \quad (2)$$

Where P is the probability that the outcome variable y is 1, $\boldsymbol{x}$ is the vector of the independent variables and $\beta_0, \beta_1 \ldots\ldots \beta_{\mathrm{k}}$ are the coefficients of the dependent variables.

The functional form of the model is stated below:

$$CHS = \beta_0 + \beta_1 MSE + \beta_2 FSE + \beta_3 MC + \beta_4 CH \quad (3)$$

Where CHS represents child malaria infection, MSE mother's socioeconomic status includes the mother's education, occupation, income and place of residence, FSE father's socioeconomic status, MC mother's individual characteristics and CH child individual characteristics.

Results

This section presents the estimation result. The binary logistic regression analyzed the causal relationship between the mother's socioeconomic status and child malaria in Nasarawa State.

Table 2

Logistic Regression Result for Child Health Indicators by All Sample Characteristics

	Model1		Model2	
Indicators:				
Mothers Education				
Primary	-0.024	(0.122)	0.098	(0.108)
Secondary	-0.297**	(0.109)	-0.107	(0.126)
NCE	-0.537***	(0.096)	-0.320**	(0.177)
Degree	-0.687***	(0.057)	-0.657***	(0.126)
Wealth Index:				
Poor	-0.086	(0.203)	-0.096	(0.210)
Middle	-0.150	(0.226)	-0.281	(0.267)
Rich	-0.096	(0.255)	-0.179	(0.307)
Place of Residence:				
Lafia	-0.070	(0.130)	0.019	(0.137)
Keffi	-0.441**	(0.130)	-0.602***	(0.141)
Akwanga	0.030	(0.140)	0.098	(0.115)
Nasarawa	0.008	(0.133)	-0.190	(0.210)
Keana	0.133	(0.128)	0.114	(0.136)
Wamba	0.042	(0.156)	0.005	(0.209)
Laminga	-0.070	(0.154)	0.003	(0.171)
Agyaragu	0.026	(0.137)	0.160*	(0.092)
Gunduma	0.046	(0.155)	-0.071	(0.226)
Iwagu	-0.008	(0.191)	0.009	(0.215)
Nakere	0.119	(0.202)	0.059	(0.235)
Occupation:				
Civil Serv.	-0.026	(0.220)	0.063	(0.185)
Private Serv.	-0.035	(0.232)	0.024	(0.213)
Marketer	0.066	(0.195)	0.120	(0.189)
Farmer	-0.031	(0.219)	-0.036	(0.236)
Fathers Socioeconomic Status:				
Primary			-0.113	(0.101)
Secondary			0.064	(0.109)
NCE			0.063	(0.125)
Degree			-0.061	(0.119)
			Wealth Index	
Poor			0.196	(0.128)
Middle			0.147	(0.158)
Rich			0.196	(0.128)
Occupation				
Civil Serv.			-0.064	(0.126)
Private Serv.			-0.094	(0.153)

	Model1	Model2		
Marketer	0.007	(0.112)		
Farmer	0.113	(0.096)		
Nutrition				
Ex. Breast	-0.544***	(0.053)	-0.317***	(0.066)
Maternal				
Factors:				
Moage1	0.038	(0.116)		
Moage2	0.048	(0.113)		
Moage3	0.004	(0.128)		
Moage4	0.070	(0.123)		
Moage5	-0.026	(0.200)		
Number of				
Child:				
3-4	0.090	(0.069)		
5-6	0.127*	(0.075)		
7 and above	0.208**	(0.065)		
Birth Space				
2 years	0.077	(0.113)		
3 years	-0.097	(0.082)		
4 years	0.071	(0.108)		
5 years and above				
Health System:				
Immunization	0.334*	(0.168)		
Hosp Del.				
Awareness				
Environ. Factor				
Toilet				
Water	-0.014	(0.074)		
Numb. Rm				
Slp1				
Slp2				
Religion	-0.021	(0.077)		
Child Gender	0.069	(0.057)		
Mosq. Net	-0.257***	(0.050)		
Married	-0.274***	(0.037)		
Ethnicity:				
Eggon	-0.455*	(0.275)		
Mada	-0.379	(0.324)		
Alago	-0.516*	(0.269)		
Afo	-0.341	(0.326)		
Gwandara	-0.135	(0.315)		
Rindre	-0.474	(0.305)		
Hausa	-0.390	(0.284)		
Others	-0.410	(0.285)		
Child age:				
2 years	0.076	(0.078)		
3 years	0.087	(0.072)		
4 years	0.037	(0.080)		
5 years	0.099	(0.079)		

Source: Field Survey (2019).

Table 2 shows the bivariate logistic regression of model 1 and model 2. Model 1 estimates only mothers' socioeconomic status as an independent variable against child malaria status with no control variables. The result shows that estimated at sample means, mothers with degree, NCE, Secondary and primary certificates were 0.68, 0.53, 0.29 and 0.02 percentage points, respectively, less likely to have under-five children with malaria fever than mothers without formal education. These were statistically significant except for the variable primary education. This implies that increasing mothers' education beyond primary certificates reduces the likelihood of mothers having children with malaria infection. The result also shows that the coefficient on other socioeconomic factors was insignificant except for Keffi, which is a variable for place of residence. The coefficient indicates that residing in Keffi reduces the likelihood of child malaria infection by 0.44 percentage points.

Model 2 analysed the relationship between the mother's socioeconomic status and child malaria infection, including all necessary control variables. The result shows that including all the required control variables, only coefficients on the mother's level of education (NCE and degree) and two variables among the place of residence (Keffi and Agyaragu) remained significant concerning the mother's socioeconomic status. Father's education also became insignificant due to the effect of essential control variables. Mother's level of education also loses significance on secondary certificates and magnitude on NCE and degree certificates. The magnitude of the association between a mother's level of education and child malaria infection reduces from 0.53 to 0.32 percentage points on the variable NCE and 0.68 to 0.65 percentage points on the variable degree certificate. Both variables were statistically significant at 1% and 5%, respectively. This implies that despite including control variables, increased levels of the mother's education (NCE and degree) were negatively associated with child malaria fever. Residing in Keffi was also found to significantly reduce the likelihood of malaria fever infection in children, while living in Agyaragu increases the probability of malaria infection by 0.16 percentage points. This can imply that residing in urban areas is advantageous in reducing child malaria infection.

Important control variables that negatively affect child malaria fever include exclusive breastfeeding (0.28 percentage point), immunisation (0.33 percentage point), mosquito net (0.25 percentage point), married (0.27 percentage point), been from Eggon ethnic group (0.45 percentage point) and been from Alago ethnic group (0.51). While having 5-6 and 7 and above children increases the likelihood of malaria fever by 0.12 and 0.20 percentage points, respectively.

Discussion

The general findings from this study show that parental education, especially the mother's education, has a higher influence on child malaria infection. The Mother's education level was a consistent and significant determinant of child malaria infection throughout the analysis. The results indicated that an increased level of mother's education reduces the risk of malaria infection in under-five children in Nasarawa State. These findings agree with the study by Anjorin et al. (2023). They reported a high prevalence of malaria infection among children of lower-education mothers. Explaining that these mothers had poor receptivity toward preventive measures and treatment of

child malaria. The point of departure from that of Nasarawa State women is that while some uneducated mothers gave herbs, those from Imo were not proactive in providing care to their children. Even though the result leads to severe malaria cases, the path differs. Another study by Gbenga-Epebinu et al. (2023) reported a similar result to Anjorin et al.'s (2023), but the intuition behind their findings differs. The study by Anjorin et al. (2023) opined that a low prevalence of malaria in children is a function of improved quality of life and better environmental sanitation, which is associated with higher educated mothers. Dawaki et al. (2016) also gave a dimension to the argument: a distance of health facilities from most rural communities where most of these lower-educated mothers live. The wide spread of healthcare facilities in Nasarawa state will, on the other hand, improve the situation if lower-educated mothers understand the importance of taking their children to the hospital when they are sick.

On the contrary, Isiko et al. (2023) found no relationship between parents' educational level and malaria infection in under-five children in Nigeria. This could be due to the data type used or the area of study. For instance, the paper studied this relationship using the Malaria Indicator Survey 2021, which is country-level data that might present a different result from state-level data. This study's results were detailed, as it studied children across the entire state who were randomly selected.

In terms of parents' income level, the results of this study show that a mother's income level was not a determinant of child malaria infection. This is a pointer to the fact that knowledge about child health prevention and healthcare access is key to having healthy children beyond income level. A similar result was reported by Isiko et al. (2023) and Enyi et al. (2023), who found no relationship between parents' income level and malaria infection in under-five children. This finding is consistent with the intuition of the finding of this result that knowing prevention and understanding of the effect of malaria infection in children far outweigh having the means of treatment. This finding is also similar to other findings, such as those that studied the relationship between occupation and child malaria. For instance, these findings also found no significant relationship between a mother's occupation and malaria infection, as reported by (Gbenga-Epebinu et al., 2023). This is plausible because occupation might not stand alone since it is a product of education and determines one's income level. This is why this study considers a separate variable for income and education as major socioeconomic factors. By exclusively feeding children, exclusive breastfeeding was reported to reduce the likelihood of child malaria infection significantly, possibly due to a more muscular immune system. Mosquito net usage was also reported to reduce the rate of malaria infection among children in Nasarawa State.

Conclusions and Implications

This study investigated the relationship between a mother's socioeconomic status and child malaria status in Nasarawa State. Mother's level of education was found to be the significant determinant of child malaria infection in the State. Mothers' education improves child malaria infection and protects against early child ill health. It is, therefore, evident that no matter the educational level or income of the father's child, ill health will continue to worsen in Nasarawa State,

except if the mother's educational levels are improved. Mothers' education and residence in urban communities of Nasarawa State can increase the chances of a mother practising exclusive breastfeeding, delivering her baby in the hospital, having access to clean drinking water, and affording modern toilet facilities. The significant contribution of this finding is that other factors like parent occupation, income, and place of residence are substantial determinants of child malaria infection in different states. Factors associated with mothers' education, such as knowledge and perception, form the primary factor of child malaria infection in the state. The study, therefore, recommends that Sensitization on the importance of women's education should be encouraged by the government at all levels, especially among rural dwellers. Establishment and improvement of government primary and secondary schools in rural communities. This is to educate future mothers to avoid future child ill health associated with poor education.

Suggestions for Future Research

The major limitation of this study is its inability to quantitatively provide the pass-through mechanisms through which factors such as mother's education influence child malaria infection in Nasarawa State. Further studies can adopt latent variable and pathway analyses to estimate these mechanisms for more specific policy direction.

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Conflicts of Interest

None.

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