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## Women's education and attitudes toward malaria in children: Evidence from Nigeria

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CASE REPORT



# Women's education and attitudes toward malaria in children: Evidence from Nigeria

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## ABSTRACT

This study examined the effect of women's educational level on their perceptions regarding the deadliness of malaria in children. The regression results revealed that women with primary education did not differ statistically from the reference category (i.e. women with no education) in terms of their likelihood of perceiving malaria as a deadly disease in children. In contrast, women with secondary education were 4.3 percentage points more likely to perceive malaria as a deadly disease compared to the reference category. Similarly, women with higher education were 8 percentage points more likely to perceive malaria as a deadly disease compared to the reference category. These results highlight the crucial role of women's education in shaping their perceptions of disease in children, which also has implications for child health outcomes.

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## SUSTAINABLE DEVELOPMENT GOALS

Quality education; Good health and well-being; Gender equality

## 1. Introduction

The Nigerian government has adopted measures such as the National Malaria Elimination Program (NMEP), the National Malaria Strategic Plan (NMSP), and the National Malaria Control Program (NMCP) to eliminate malaria; yet, it remains one of the leading causes of death in Nigeria, particularly among children under the age of five. In 2023, there were 608,000 deaths from malaria globally, with Nigeria alone accounting for 31% of those deaths, making it the most affected country in the world (World Health Organization, 2023). Although malaria is preventable and treatable, many Nigerians still do not fully recognise how deadly this disease can be. The Malaria Indicator Survey (MIS), conducted in Nigeria in 2021 as part of the Demographic and Health Surveys (DHS), revealed that 43% of women aged 15–49 agreed with the statement, 'Only weak children can die from malaria.'

Such nonchalant attitudes toward malaria's deadliness are particularly disturbing because they can prevent women from seeking medical help when children are ill. Moreover, in countries like Nigeria, where gender norms are pronounced and women are expected to be *homemakers* who manage the home and children, mothers are likely to be the ones deciding whether to seek medical help when a child is ill. Women's educational level might influence their perception of malaria, which in turn could affect their response to the disease. For instance, educated mothers might

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take the disease more seriously because they have better access to information about its deadliness due to their ability to read.

Yet, societal gender norms that expect women to be *homemakers* also limit their educational attainment. For instance, the Wave 7 World Values Survey (WVS) (Haerpfer et al., 2022; Inglehart et al., 2014), conducted in 2017, shows that 42% of Nigerians believe a university education is more important for boys than girls. The same survey also reveals that 41% of Nigerians agree that ‘when a mother works for pay, the children suffer.’ A recent study conducted in Nigeria by Tuki (2024) finds that education reduces the likelihood of individuals agreeing that boys should receive preferential treatment in terms of educational access.

The negative effect of gender norms on women’s education is problematic. This is because women’s education has ripple effects, leading not only to direct improvements in their own lives (e.g. by increasing their employability), but also to better health outcomes for their children. For instance, Keats (2018) conducted a study in Uganda and found that children born to educated mothers were more likely to receive vaccinations and less likely to be malnourished. Analysing the Demographic and Health Survey (DHS) data for Nigeria, Fadare et al. (2019) found a positive correlation between mothers’ education and nutrition outcomes in infants. In their study, also conducted in Nigeria, Uthman et al. (2008, p. 1) concluded that ‘A well-educated mother has a better chance of satisfying important factors that can improve infant survival: the quality of infant feeding, general care, household sanitation, and adequate use of preventive and curative health services.’ Similarly, Victoria et al. (1992) conducted a study in Brazil and found that infants born to women with no education were more likely to die from infectious diseases such as diarrhea and pneumonia. Studies showing the negative correlation between women’s education and infant mortality have been conducted in Ethiopia (Kiross et al., 2019), the United States (Gage et al., 2013; Green & Hamilton, 2019), Nicaragua (Sandiford et al., 1995), Indonesia (Schellekens, 2021), and using global data (Gakidou et al., 2010).

Yet, despite the numerous studies conducted on how women’s education affects health outcomes globally, including some specifically focusing on Nigeria (e.g. Adewusi & Nwokocha, 2018; Ade-wuyi et al., 2017; Nwanze et al., 2023; Shobiye et al., 2022), there is generally a lack of research on how women’s education influences their attitudes toward disease in children. It is important to study this relationship because actions are often based on perceptions. This study aims to fill this gap using the Malaria Indicator Survey (MIS) dataset collected in 2021, which is representative of Nigerian women aged 15–49. Specifically, it examines how women’s education influences their attitudes regarding the deadliness of malaria in children.

To measure women’s perceptions of malaria’s deadliness, this study used responses to the statement, ‘Only weak children can die from malaria.’ Respondents could either agree or disagree with the statement, or choose the ‘don’t know/uncertain’ response category. Educational level was measured on a scale with four ordinal categories, ranging from ‘0 = no education’ to ‘3 = higher education.’ Using the subsample of women with no education as the reference category, dummy variables were created for those with primary, secondary, and higher education, respectively. The regression results showed that women with only primary education did not differ statistically from those with no education in their perceptions of the deadliness of malaria in children. However, having secondary or higher education both increased the likelihood of women perceiving malaria as a deadly disease compared to the reference category. These results indicate that the positive effect of education on women’s recognition of malaria’s deadliness becomes evident only when education extends beyond the primary school level.

The results of this study highlight the importance of women’s education in the fight against malaria in Nigeria. The remainder of this study is organised as follows: Section 2 introduces the survey data, operationalises the variables used to estimate the regression model, and specifies the model’s general form. Section 3 presents and discusses the regression results, while Section 4 summarises the study and concludes.

## 2. Data and methodology

This study relies on the Malaria Indicator Survey (MIS), conducted by the National Malaria Control Division of the Nigerian Ministry of Health in 2021. This dataset is part of the Demographic and Health Surveys (DHS) programme.<sup>1</sup> To select the interview locations, all households across Nigeria's 36 states and the federal capital territory (i.e. Abuja) were listed and divided into enumeration areas called clusters. Consequently, 568 clusters were selected, with 195 of them in urban areas and 373 in rural areas. The clusters were selected to be representative of the states across the country. Furthermore, the probability of a cluster being selected was proportional to its size – i.e. the number of households residing within it. An average of 25 households were randomly selected for interviews within each cluster. A total of 14,477 women aged 15–49 years were interviewed. The data are representative of Nigerian women within this age bracket because they were collected using probabilistic sampling.<sup>2</sup>

### 2.1. Operationalisation of the variables

#### 2.1.1. Dependent variable

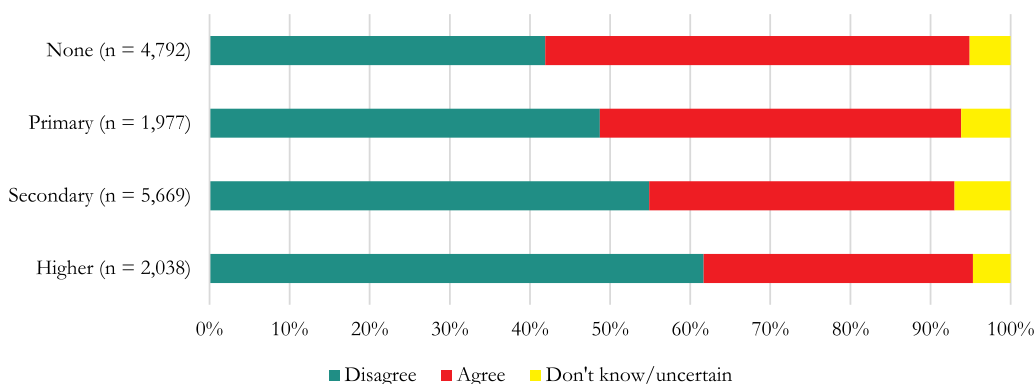
The dependent variable – i.e. *perception of malaria's deadliness* – measures the degree to which respondents believe malaria is a deadly disease for children. Specifically, it was derived from the responses to the statement, 'Only weak children die from malaria,' with respondents given the following response options: '1 = agree,' '0 = disagree,' and '8 = don't know/uncertain.' Respondents who disagreed with the statement were coded as 1, and those who agreed with it as 0. Respondents who chose 'don't know/uncertain' were treated as missing observations, leading to a marginal decrease in the sample size. Of the 14,476 women who were asked this question, 7,339 (51%) disagreed with the statement, 6,277 (43%) agreed with it, while 860 (6%) said that they did not know or were uncertain.

An alternative version of the dependent variable – i.e. *perception of malaria's deadliness 2* – was developed in which 'don't know/uncertain' responses were coded as '0' along with the 'agree' response category, rather than being treated as missing observations. These two sets of responses were combined because neither explicitly disagrees with the statement asserting that only weak children can die from malaria. A benefit of using this operationalisation compared to the previous one is that it mitigates the problem of listwise deletion, allowing for the regression model to include more observations.

#### 2.1.2. Explanatory variable

The explanatory variables measure the highest level of education attained by the respondents. Educational level was measured on a scale with the following four ordinal categories: '0 = no education,' '1 = primary,' '2 = secondary,' and '3 = higher.' 33% of the respondents had no education, 14% had primary education, 39% had secondary education, and 14% had higher education. Using the subsample of women with no education as the reference category, dummy variables were developed for the remaining three educational levels – i.e. *primary school*, *secondary school*, and *higher education*. The dummy variables take a value of 1 if the respondents' highest level of education falls into the category of interest, and 0 otherwise. For example, the variable for *primary school* takes a value of 1 if primary school is the highest educational level attained by the respondent, and 0 if the respondent has no education, secondary education, or higher education.

Figure 1 juxtaposes women's educational levels with their responses to the statement, 'Only weak children can die from malaria.' A cursory look at the figure reveals that disagreement with the statement increases with educational attainment. Among women with no education, 42% disagreed with the statement. For women with primary education, the figure was 49%. Among women with secondary and higher education, the figures were 55 and 62%, respectively. Conversely, agreement with the statement decreases steadily as educational attainment increases.



**Figure 1.** Educational distribution of responses to the statement, ‘Only weak children can die from malaria’.

Note: The figure visualises the distribution of women’s responses to the statement, ‘Only weak children can die from malaria,’ across different educational levels. The y-axis shows the four educational levels and the number of women belonging to each category, while the x-axis displays the percentage of women associated with each of the three responses to the statement.

### 2.1.3. Control variables

I considered some control variables, including household wealth, the gender of the household head, previous births, respondents’ age, whether a child aged under five years old resided in the household, and the use of mosquito nets.

**2.1.3.1. Wealth index.** This measures the value of assets possessed by the respondents’ households. In the survey, respondents were asked whether their household owned cars, motorcycles, radios, etc. The responses were measured binarily (i.e. 1 = yes, 0 = no). Ordinal weights were assigned to the assets in the following order: 6 = car/truck, 5 = motorcycle/scooter, 4 = bicycle, 3 = refrigerator, 2 = television, 1 = radio. These ordinal values reflect the monetary value of the assets. For example, a truck is generally more expensive than a motorcycle, and a television is typically more expensive than a radio. The values were then summed across the items to develop a wealth index, which ranges from 0 to 21. Higher values denote a higher level of household wealth.

**2.1.3.2. Female household head.** This takes a value of 1 if the head of the household is female and 0 if male.

**2.1.3.3. Ever given birth.** This takes a value of 1 if the respondent has ever given birth and 0 otherwise.

**2.1.3.4. Child under five.** This takes a value of 1 if there is at least one child under five years old residing in the household, and 0 otherwise.

**2.1.3.5. Age.** This is measured in years.

**2.1.3.6. Use of mosquito net.** This variable is based on responses to a question about the type of mosquito net used the previous night. The responses were categorised as follows: ‘0 = no net,’ ‘1 = treated nets,’ and ‘3 = untreated nets.’ Using the subsample of women who had not used a mosquito net as the reference category, dummy variables were developed for the remaining two response categories – i.e. *treated mosquito net* and *untreated mosquito net*.

Table 1 reports the summary statistics for all the variables.

**Table 1.** Descriptive statistics.

Variable	Total observations	Mean	Standard deviation	Minimum	Maximum
Perception of malaria's deadliness <sup>σ</sup>	13616	0.539	0.498	0	1
Perception of malaria's deadliness 2 <sup>σ</sup>	14476	0.507	0.5	0	1
Primary school	14477	0.137	0.343	0	1
Secondary school	14477	0.392	0.488	0	1
Higher education	14477	0.141	0.348	0	1
Wealth index	14350	4.949	4.624	0	21
Female household head	14476	0.148	0.355	0	1
Age	14476	28.609	8.99	15	49
Ever given birth	14477	0.715	0.451	0	1
Children under five	14477	0.677	0.468	0	1
Treated mosquito net	14476	0.381	0.486	0	1
Untreated mosquito net	14476	0.011	0.106	0	1

Note:  $\sigma$  is the dependent variable.

## 2.2. Analytical technique

The general form of the regression model to be estimated can be expressed thus:

$$\gamma_{ij} = \beta_0 + \beta_1 \text{educational level}_i' + \beta_2 \varphi_i' + \mu_i \quad (1)$$

Where  $\gamma_{ij}$  is the dependent variable which measures whether or not respondent  $i$  who resides in cluster  $j$  believes malaria is a deadly disease for children,  $\text{educational level}_i'$  is a vector of dummy variables measuring primary, secondary, and higher education,  $\varphi_i'$  is a vector of control variables discussed in Section 2.1.3,  $\beta_0$  is the constant term,  $\beta_1$  and  $\beta_2$  are the coefficients of the explanatory and control variables, respectively, and  $\mu_i$  is the error term. A linear probability model (LPM) was used to estimate the regression because the dependent variable is measured binarily. A benefit of this approach is that it allows for easy interpretation of the regression coefficients, since they represent probabilities. As a robustness check, logistic regression was used as an alternative estimation method.

The variables were added to the model in a stepwise manner to mitigate the problem of multicollinearity. Multicollinearity occurs when two or more predictor variables in a regression model are highly correlated, which can lead to inflated standard errors and biased coefficient estimates. Additionally, the stepwise approach helps prevent a scenario where the regression results depend on the inclusion of a specific combination of variables in the model.

To account for time-invariant factors that could confound the relationship between the dependent and explanatory variables – such as cultural beliefs unique to specific communities, the organisation of communities, or physical terrain – I included fixed effects for the clusters where respondents resided. For example, certain societies might have beliefs about the origin of diseases that could influence how malaria is perceived by community members. Moreover, higher altitudes can affect the spread of vector-borne diseases; for instance, malaria is less common in high-altitude regions due to the cooler climate, which is less favourable for mosquito breeding. Robust standard errors were used while estimating the regression models.<sup>3</sup>

## 3. Results and discussion

Table 2 presents the results of regression models examining the effect of educational level on women's attitudes regarding the deadliness of malaria in children. Models 1 to 3 are based on an operationalisation of the dependent variable in which 'don't know/uncertain' responses were treated as missing – i.e. *perception of malaria's deadliness*. Model 1 is a baseline model, where perceptions of malaria's deadliness were regressed on dummy variables for the three levels of education – i.e. primary, secondary, and higher education – using the subsample of women with no education as the reference category. Only the primary school variable was statistically insignificant, suggesting

**Table 2.** Regressing perceptions of malaria's deadline on educational level.

Dependent variables:	Perception of malaria's deadline			Perception of malaria's deadline 2		
	(1) LPM	(2) LPM	(3) Logit (odds ratios)	(4) LPM	(5) LPM	(6) Logit (odds ratios)
<i>Educational level</i>						
<i>No education (reference)</i>						
Primary school	0.008 (0.015)	0.004 (0.015)	1.021 (0.074)	0.004 (0.015)	0.004 (0.015)	1.02 (0.07)
Secondary school	0.043*** (0.014)	0.033** (0.015)	1.177** (0.084)	0.034** (0.014)	0.037** (0.014)	1.194*** (0.081)
Higher education	0.08*** (0.018)	0.072*** (0.018)	1.428*** (0.128)	0.086*** (0.018)	0.088*** (0.018)	1.518*** (0.129)
Wealth index		0.002* (0.001)	1.01* (0.005)		0.002 (0.001)	1.007 (0.005)
Female household head		0.003 (0.013)	1.017 (0.065)		0.003 (0.013)	1.017 (0.061)
Age		−0.001 (0.001)	0.995 (0.003)		−0.001 (0.001)	0.996 (0.003)
Ever given birth		0.009 (0.013)	1.043 (0.065)		0.039*** (0.013)	1.204*** (0.071)
Child under 5		0.007 (0.01)	1.037 (0.052)		−0.001 (0.01)	0.997 (0.047)
<i>Use of mosquito net</i>						
<i>Does not use net (reference)</i>						
Treated mosquito net		0.033*** (0.01)	1.176*** (0.056)		0.033*** (0.01)	1.17*** (0.053)
Untreated mosquito net		0.136*** (0.04)	1.933 (0.378)		0.142*** (0.039)	1.957*** (0.36)
Constant	0.462*** (0.093)	0.459*** (0.095)	0.813 (0.309)	0.451*** (0.091)	0.42*** (0.093)	0.689 (0.257)
Cluster fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
No. of clusters	568	568	568	568	568	568
Observations	13616	13494	13348	14476	14350	14253
R-squared	0.193	0.195		0.166	0.169	
Pseudo R <sup>2</sup>			0.147			0.128
Log pseudolikelihood			−7853.686			−8611.614
AIC statistic	17898.91	17738.92	16847.37	19511.81	19329.98	18369.23
BIC statistic	22169.7	22072.19	21121.87	23817.39	23698.74	22703.81

Notes: Robust standard errors are in parentheses. \*\*\* $p < 0.01$ , \*\* $p < 0.05$ , \* $p < 0.10$ . Models 1, 2, 4, and 5, were estimated using a linear probability model (LPM). Models 3 and 6 were estimated using logit regression and report the odds ratios. In the first dependent variable (i.e. perception of malaria's deadline), 'don't know/uncertain' responses were treated as missing observations. In the second dependent variable (i.e. perception of malaria's deadline 2), 'don't know/uncertain' responses were combined with those agreeing with the statement that 'Only weak children can die from malaria.'

that women with only primary education do not differ from those with no education in their perception of malaria's deadline. This might be because primary education typically focuses on basic literacy and numeracy skills, often lacking deeper critical thinking or specialised knowledge areas. Moreover, factors such as inadequate infrastructure, insufficient qualified teachers, and lack of learning materials can contribute to poor educational outcomes at the primary level. This results in a scenario where having primary education does not provide a cognitive advantage over having no formal education.

Conversely, the variables measuring secondary and higher education were both statistically significant at the 1% level and carried negative signs. This suggests that, compared to women with no education, those with secondary and higher education are more likely to perceive malaria as a deadly disease. In other words, they are more likely to disagree with the statement that only weak children can die from malaria. It is important to note that the effect size is larger among women with higher education compared to those with secondary education. Specifically, women with secondary education are 4.3 percentage points more likely to perceive malaria as a deadly disease compared to their counterparts with no education. Similarly, women with higher education are

8 percentage points more likely to perceive malaria as a deadly disease compared to those with no education. Educated women might be more likely to view malaria as a deadly disease in children because their ability to read and write enables them to access relevant information about the disease's deadliness. Moreover, secondary and higher education (compared to primary education) expose individuals to a broader range of ideas and perspectives, which can enhance open-mindedness and intellectual curiosity.

With the inclusion of control variables in model 2, the coefficients of the explanatory variables reduced slightly, and the statistical significance of the variable measuring secondary education dropped to 5%. However, the results remained consistent with those in preceding model. Among the control variables, only the wealth index and the variables measuring the use of mosquito nets were statistically significant. The positive sign associated with the wealth index suggests that belonging to a wealthy household increases the probability of perceiving malaria as a deadly disease. Specifically, a one-unit increase in the wealth index raises the probability of women perceiving malaria as a deadly disease by 0.2%. This may be due to higher income levels offering improved access to education and health information, which increases awareness of health issues and preventive strategies. Additionally, higher income often signifies better health insurance coverage, reducing the financial strain of medical costs and promoting a more health-conscious attitude. The positive sign accompanying the variable measuring the use of treated mosquito nets indicate that, compared to the reference category (women who do not sleep under mosquito nets), those who sleep under treated nets are 3.3 percentage points more likely to perceive malaria as a deadly disease in children. Similarly, women who sleep under untreated mosquito nets are 13.6 percentage points more likely to perceive malaria as a deadly disease in children.

In model 3, a robustness check was conducted using logit regression as an alternative estimation method. Only the odds ratios are reported. Similar to the preceding models, the primary school variable was statistically insignificant, while the variables measuring secondary and higher education were both statistically significant. Specifically, these results reveal that compared to women with no education, possessing secondary education increases the odds of perceiving malaria as a deadly disease by 17.7 percentage points. Likewise, possessing higher education increases the odds of perceiving malaria as a deadly disease by 42.8 percentage points.

Models 4 to 6 are similar to models 1 to 3, except that they use a different operationalisation of the dependent variable – *perception of malaria's deadliness 2*. This variable combines 'don't know/uncertain' responses with those agreeing with the statement that only weak children can die from malaria. The rationale for combining both responses is that neither explicitly disagrees with the statement. A benefit of this operationalisation – compared to *perception of malaria's deadliness* – is that it mitigates the problem of listwise deletion, allowing for more observations to be included in the regression model.

A cursory look at models 4 to 6 shows that the main results are consistent with those reported in models 1 to 3, with only a few exceptions. The variable controlling for previous births became statistically significant. Its positive sign suggests that compared to women who have never given birth, those who have are more likely to perceive malaria as a deadly disease. This might be due to women's maternal instincts, which make them feel a sense of responsibility for the health and well-being of their children. It could also be that women who have given birth have more access to health information because they are more likely to have been exposed to antenatal care.

The wealth index also became statistically insignificant, suggesting that household wealth has no impact on women's perceptions of malaria's deadliness. Furthermore, the size of the explanatory variables' coefficients increased marginally when control variables were added (i.e. model 5). This contrasts with the case of model 2 where the opposite occurred. The results in model 6 are also similar to those in model 3, except that the odds ratios are slightly higher in model 6. The slight differences between the two sets of models (i.e. models 1–3 and models 4–6) may be due to the use of different dependent variables. Moreover, models 4–6 include about 1,000 more observations than models 1–3. Nevertheless, these differences do not alter the main regression results, which show



that minimal education (i.e. primary education) does not significantly affect women's attitudes regarding malaria's deadliness.

#### 4. Conclusion

This study examined the effect of education on attitudes regarding the deadliness of malaria in children among Nigerian women aged 15–49 years. The regression results revealed that women with only primary education did not differ from those with no education in their perceptions of malaria's deadliness. However, those with secondary and higher education were more likely than their counterparts with no education to perceive malaria as a deadly disease. These results highlight the important role that women's education plays in the fight against malaria. If the Nigerian government intends to win this battle, it needs to pay serious attention to women's education. The salience of gender norms in Nigerian society implies that most childcare responsibilities rest with women, placing them in a position to decide whether a sick child receives medical attention. Although this study focused specifically on perceptions regarding the deadliness of malaria for children rather than on child health outcomes, the results are still relevant because actions are often predicated on perceptions.

#### Notes

1. To access the Malaria Indicator Survey (MIS) dataset and the codebook visit: <https://dhsprogram.com/data/available-datasets.cfm>.
2. For a detailed discussion of the survey design, see the first chapter of the Malaria Indicator Survey (MIS) final report: <https://dhsprogram.com/pubs/pdf/MIS41/MIS41.pdf>.
3. Alternative models in which standard errors were clustered at the enumeration area (i.e., cluster) level were estimated. The main regression results remained unchanged. These results have not been reported in the paper.

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#### Disclosure statement

No potential conflict of interest was reported by the author(s).

#### Data availability statement

The 2021 Malaria Indicator Survey (MIS) dataset for Nigeria is publicly available in the Demographic and Health Surveys (DHS) database: <https://dhsprogram.com/Data/>. The do-file underlying the regression models is available in the Harvard Dataverse: <https://doi.org/10.7910/DVN/RKZE7Q>.

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