



## **Mothers Education and Respiratory Infection in Under-Five Children in Nigeria**

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### **Authors' contributions**

*This work was carried out in collaboration between both authors. Author JP designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Author DAOK managed the analyses of the study and managed the literature searches. Both authors read and approved the final manuscript.*

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### **ABSTRACT**

Respiratory infection is one of the major causes of child ill health and mortality not only in Nigeria, but in most developing countries of the world. This study therefore, investigated the causal relationship between mothers' level of education and under-five age respiratory infection in Nigeria. Probit regression is used to analyse data from Nigeria Multiple indicator cluster survey 2017. Results from the bivariate regression indicated a significant negative relationship between mothers' educational level and respiratory infection in under-five age children in Nigeria. Mothers' educational level became insignificant after controlling for other important covariates which signifies an indirect relationship with child respiratory infection. This implies that mothers' education influences child respiratory disorder through other variables like place of residence and immunization. Other variables found to influence child respiratory infection includes region of residence, age of child, immunization and ethnicity. On the other hand, sex of child and wealth index were not found to be significant determinants of child respiratory infection. Nigerian government should encourage girl child education through the provision of free quality education at least to secondary school level. Programs to target free diagnosis, treatment and prevention of

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respiratory infection especially among under-five children should be prioritized by the ministry of health. Health care providers should also intensify awareness to mothers on preventive measures of child respiratory infection especially during antenatal care programs.

*Keywords: Respiratory infections; mothers' education; under-five age; multiple indicator survey.*

## 1. INTRODUCTION

Respiratory tract infections (RTIs) are a major cause of morbidity and mortality worldwide. According to the United Nation's International Children's Emergency Fund (UNICEF) (2016) report, acute lower respiratory tract infections have been among the top three causes of death and disabilities among children, although the burden is difficult to ascertain.

Recent estimates show that respiratory infections account for 6% of the total global burden of disease; this is a higher percentage compared with the burden of diarrheal disease, cancer, human immunodeficiency virus (HIV) infection, ischemic heart disease or malaria [1]. Sub Saharan Africa is ranked as the highest regional contributor to under five mortality and acute respiratory infections with over a million deaths of young children of which Nigeria is among countries of high burden in 2015 as reported by [2]. This high mortality rate in Nigeria is a matter of great concern not only to government organization, but non-governmental health organization as well. The major reason for this concern is that these causes of child mortality in Nigeria are common child illnesses that are preventable with adequate health care provision for children.

In Nigeria for instance, 500 million USD credit was approved in 2015 from the World Bank of which \$55.5 of this money was released to the ministry of health through the program Saving One Million Lives Program for Result (SOML PforR) aimed at cutting down maternal and child mortality rate (SOML PFORR, 2017). Despite this and many other interventions, child mortality remains unacceptable high in Nigeria.

Respiratory disorder is diseases of the airways and the other structures of the lungs including asthma, respiratory allergies, chronic obstructive pulmonary disease, and occupational lung diseases (WHO, 2007). The symptoms are usually fever with cough and difficulty in breathing. These infections can be normally classified into: upper and lower respiratory tract infections; and as well as chronic and acute respiratory tract infections.

Gyawali, Pahar, Maharjan and Khadka [3] examined that knowledge level of acute respiratory tract infections amongst mothers with children under the ages of five years is a key factor to consider outside of clinical factors. This is because mothers generally are referred to as the main care givers of children under five who are in close contact with their mothers. Therefore, any deviation in the health of children is first recognized by their mothers especially where there are visible signs and symptoms of these diseases or infection. Also, Soleimani, Shahri, Teimouri, Sargolzaei, Ghavampour, [4] reported that the cause of respiratory tract infections especially the upper respiratory tract infections is usually viral but parent's attitudes often contribute to appropriate prescription of antibiotics thereby promoting antibiotic resistance.

The prevalence of acute respiratory infection is found to be determined individually and collectively by a number of factors which include; age, sex, nutritional status, breast feeding, socio economic status, overcrowding, indoor pollution, passive smoking, place of residence and immunization. For instance, Ujunwa and Ezeonu [5] reported that education and place of residence are key determinants, Sanni and Ghose [6] reported that household wealth and socioeconomic status are the key factor causing respiratory tract infections in children; Adesanya and Chiao [7] emphasizes immunization as a determining factor of child respiratory disorder. While, Solomon, Odu, Amu, Solomon, Bamidele, Emmanuel, Adetokunbo and Parakoyi, [8] opined that education is not an important determinant of child respiratory disorder.

This paper therefore, uses MICS 2017 data to examine mothers' level of education and child respiratory disorder with the hope of resolving these differences in respect to factors responsible for child respiratory disorder. This is important because very few studies examine this relationship in Nigeria and the few studies either used state level data or Nigeria Demographic Survey 2013 which is an older data.

## 2. THEORETICAL AND LITERATURE REVIEW

### 2.1 Theoretical Framework

This paper based its theoretical framework on the theory of health capital by Grossman (1972) as modified by Jacobson (2000). The theory of health capital was formulated due to the inadequacy of the theory of human capital to explain the workings of health as component of human capital. Human capital theory proposes that investment in human capital (health and education) decreases with increased age, due to the fact that returns on human capital decrease at older age (Becker, 1964). This is reasonable with returns on education, because increase in education leads to higher earnings and earned income declines to zero at retirement age. Grossman (1972) on the contrary explains that investment in health increases at older age even when earned income declines to zero. This contradiction between health as component of human capital and education led to the formulation of health capital theory and was justified by the fact that medical services are demanded not for the sake of the service per se, but for good health (Galama and Kippersluis, 2010). Grossman (1972) therefore assumed that an individual's initial health stock at birth depreciates with increase in age which can be augmented by investment in health through the purchase of medical services, healthy consumption, exercise, good housing, recreation, diet and individual level of education.  $H_1$  in the Grossman model below signifies health stock which is a function of initial health ( $H_0$ ), but depreciates with increase in age  $\delta$  which can also be improved upon by investment in medical services ( $M$ ) and health preventive efforts. This implies that age and unhealthy behaviours worsen health, while investment in medical services and healthy activities improves health stock. Education on the other hand is viewed as an efficient factor that enhances investment in health.

$$H_1 = H_0(1 - \delta) + I(M, t) \quad (1)$$

Jacobson (2000) commended Grossman's model to have contributed to the knowledge of health behaviour, variation in health care use and health disparities among different households. Jacobson (2000) formulated family as producer of health model as an extension of Grossman's theory to include the influence of parents on the health of their children, which cannot be analyzed using

Grossman's model. Family as producer of health proposes that parents not only produce their own health but the health of their children. This is because parents do not only derive satisfaction from being healthy but also for the health of their children. Grossman's model pointed out that efficient production of health depends on individual education, while family as producer of health model added that efficient production of child health is a function of parents' education with resources such as family income, consumption goods and family wealth as input in the production process.

$$H_c = f(I_t, Z_t) \quad (2)$$

$H_c$  is child health, while  $I_t$  and  $Z_t$  are variables for investment in child health through health care utilization, parents' education, households' wealth and market goods. This paper will emphasize parents' education as an important variable determining child health. This paper will use mothers' level of education as a proxy for parent education and the control variables will be moderated based on literature review.

### 2.2 Empirical Literature Review

Empirical literatures are reviewed based on factors influencing child respiratory status. Some of these factors include mothers' educational level, household wealth, place of residence, immunization status and ethnicity.

Ujunwa and Ezeonu [5] examine risk factors for acute respiratory tract infections in under-five children in Enugu, Nigeria. Chi-square test was used to analyse data and the result shows a significant negative relationship between mothers' level of education and child respiratory disorder. This finding agrees with the study of Tazinya, Halle-Ekane, Mbuagbaw, Abanda, Atashili and Obama [9] who assessed the proportion of acute respiratory infections and the associated risk factors in children under 5 years visiting the Bamenda Regional Hospital in Cameroon, using cross-sectional primary data for analysis with the statistical software Epi-Info version 7. He concluded that the proportion of ARI was high and was associated with HIV infection, poor maternal education, exposure to wood smoke, passive cigarette smoking, and contact with persons having cough. Control programs should focus on diagnosis, treatment and prevention of ARIs in order to reduce the morbidity and mortality associated with ARI.

Gebertsadik, Worku, and Berhane [10] examined the factors associated with acute respiratory tract infections (ARI) in children under the age of 5 years in Ethiopia using the existed 2011 Ethiopia Demographic and Health Survey reports. Logistic regression analysis was employed for the analysis and ARI in the study was associated with severe malnutrition. Children who were severely wasted were highly likely to develop ARI. Their findings show that ARI was less likely to occur in children from families with educated fathers and professional mothers, therefore concluded that malnourished children from a lower socioeconomic category are more likely to suffer from ARI. Targeting disadvantaged children for effective interventions can help reduce the burden of morbidity and death due to ARI.

Other scholars investigated the relationship between ARI in children and level of mothers' education. They found a higher chance of developing an ARI in children with less educated mothers compared to children with more educated mothers (secondary education and above). This is probably because children spend more time with their mothers, and mothers' educational level will determine the quality of care, social and environmental factors that the child will be exposed to (Mathew, Patwari, Gupta, Shah, Gera and Gogia, et al, 2001) [11,12].

In contrast, Solomon, Odu, Amu, Solomon, Bamidele, Emmanuel, Adetokunbo and Parakoyi (2018) study prevalence and risk factors of acute respiratory infection among under-fives in rural communities of Ekiti State using chi-square test as method of analysis. This study reported insignificant relationship between mothers' level of education and child respiratory disorder. Solomon et al (2018) opined that mothers' level of education is not an important determinant of child respiratory disorder. One reason for these differences could be due to regional specific factors.

Tazinya, Halle-Ekane, Mbuagbaw, Abanda, Atashili and Obama [9] studied the proportion of acute respiratory infection and other risk factors, which serve as leading cause of morbidity and mortality in under-five children worldwide. The study utilized a hospital based cross-sectional survey data and analyzed same data using statistical software EpiInfo™ version 7. The finding indicated that the risk factors significantly associated with ARI were HIV, poor maternal education, passive smoking, exposure to wood smoke and contact with person having ARI.

Other factors found to significantly influence child respiratory infection includes: household wealth [7,13]; Immunization [14] and ethnicity [7]. These previous studies argued that parental socioeconomic status only influence child respiratory disorder through these listed factors. This is because respiratory disorder is majorly airborne disease that are directly influence by other factors and can be curtail through immunization.

### 3. METHODOLOGY

This study uses secondary data for analysis. The data was collected from Nigeria Multiple Indicator Cluster Survey (MICS 5) 2017. Nigeria MICS 2017 was conducted by National Bureau of Statistics (NBS) between September 2016 and January 2017, funded by World Health Organization (WHO), United Nations Children's Fund (UNICEF), Bill and Melinda Gates Foundation and NACA (NBS, 2019). NBS (2019) report added that Nigeria MICS 2017 was designed to provides estimates for several indicators on the situation of children, women and men at the national level, states level, urban/rural and the six geopolitical zones.

Nigeria MICS 2017 uses four different questionnaires to collect data on household, individual women, individual men and children under the age of five. The household questionnaire was used to collect information about household size, composition, asset, household head occupation and educational level, age, gender, immunization status of children, insecticide bed net usage and child labour. The individual women questionnaire was used to collect information on women between the ages of 15-49 years about their background, fertility/birth history, maternal and new birth health, contraceptive use, marital status, access to mass media and behavioural characteristics. The men questionnaire was used to collect information on men within the ages of 15-49. Information collected from men are similar to that of women questionnaires. The fourth questionnaire is the under – five children questionnaire. This questionnaire was administered to mothers with children between the ages of five and zero. Information was collected about children under – five years living condition, age, gender, health condition including respiratory disorder, early child development, immunization, breast feeding and dietary intake and care of illness. The MICS 2017 successfully

interviewed 33,901 households, 34,376 women, 15,514 men and 28,085 children (NBS, 2019).

### 3.1 Data Variables

#### 3.1.1 Dependent variable

The theoretical framework shows that child health represented by respiratory status in a child is determined by variables such as mother's demographic and social characteristics, child characteristics and child living condition. Child respiratory condition is used as dependent variable for this paper. A child has respiratory disorder if he/she had cough two weeks preceding the survey and a severe case when a child finds it difficult to breathe during period of cough. While, a child is considered not to have respiratory disorder if he/she did not suffer from cough two weeks preceding the survey.

#### 3.1.2 Independent variables

The independent variables are explained variables that determine respiratory disorder in under – five years' children. These variables are briefly explained below:

- Mother's educational level: this is a category variable that categorized mothers' education into no education, non-formal education, primary education, secondary education and higher educational level. Mothers with no education are used as reference against the other categories of educational levels.
- Wealth index: this variable categorized income level of household into poorest, poorer, middle income, richer and richest. The poorest households will be used as reference variable against which the other categories will be measured.
- Ethnicity: households are grouped according to the ethnic affiliation of the household head. These categories are Hausa, Igbo, Yoruba and other Nigerian languages.
- Age of child: children are grouped into five age groups, which comprise of children age one and below, age two, age three, age four and age five.
- Place of residence: households are categorized into rural and urban areas according to the characteristics of the areas of their residence.
- Immunization: this represents immunization status of children below the age of five. Children are immunized when they took

Bacillus Calmette Guerin (BCG) to protect children against respiratory disorder. A child is coded one if he/she received this immunization and zero if a child did not receive the immunization.

The variable mothers' education is the variable of interest as regards this paper, while other variables are used as control variables.

### 3.2 Models

The data obtained were analysed using Probit regression model. The choice of probit model is due to the binary nature of the dependent variable (1 if a child had cough two weeks preceding survey and 0 otherwise). Probit regression is suitable for analyzing binary dependent variable because it assumes a generalized function that takes values strictly between 0 and 1. The dependent variable is 1 if the probability of event (cough) occurring is above a certain threshold and 0 if the probability is below that threshold. Therefore, the function G ensures that estimated probabilities of the estimated independent variables lie within the same range of 0 and 1.

$$P\left(y = \frac{1}{x}\right) = G(\beta_0 + \beta_1 X_1 + \dots + \beta_k X_k)$$

Where p is the probability that the dependent variable is 1 given the vector of independent variables x, while  $\beta_0, \dots, \beta_k$  are the coefficients of the independent variables.

The implicit and explicit form of the model with respect to this paper is specified below:

$$CHC = f(ME, HA, HW, CC) \quad (1)$$

$$P\left(CHU_i = \frac{1}{x}\right) = G(\gamma_0 + W_i \gamma_1 + Med_i \gamma_2 + U_i \gamma_3 + Reg_i \gamma_4 + CC_i \gamma_5 + HC_i \gamma_6 + Fs_i \gamma_7) \quad (1b)$$

Where:

Med = Mothers' level of education  
 W = wealth index  
 U = place of residence  
 Reg = Geopolitical zone  
 CC = Child age  
 HC = Child gender  
 Fs = Immunization status  
 Eth = Ethnicity

## 4. RESULTS

### 4.1 Descriptive Statistics

Table 1 above presents the raw characteristics of the relationship between respiratory disorder in

under five child and possible determining factors. The table shows chi-square computation which comprises of frequency and percentage distribution of the data. The frequency distribution shows that 6,882 children had fever with cough, out of which 26 percent of the children had mothers with no education, 32 percent had mothers with non-formal education, 23 percent had mothers with primary education, 22 percent had mothers with secondary education while 17 percent of the children that had fever with cough had mothers with tertiary education. This shows that majority of children that had fever with cough came from households where the mothers had lower level of education. Table 1 also shows similar trend with respect to wealth index. Children from poorest households have more prevalence of fever with cough (28 percent), compared to their counterparts from the richest household (18 percent). 5,368 (26 percent) children who reside in the rural areas had fever with cough compared to only 1,515 (20 percent) children residing in the urban areas. The relationship between mothers' educational level, wealth index, place of residence and child respiratory disorder symptom shows that parents' level of socioeconomic status impact negatively on respiratory disorder in under five children in Nigeria.

The relationship between ethnicity and child ill health with respect to cough is intended to uncover the impact of culture on child respiratory disorder. The chi-square distribution shows that 4068 (30 percent) children who had cough had Hausa mothers, 632 (20 percent) had Igbo mothers and 410 (15 percent) had Yoruba mothers. Comparing the result with that of the geopolitical zones gives better understanding. Children from the North west and North east (31 and 29 percent respectively) had higher level of prevalence of cough compare to children from South East and South west (21 and 15 percent respectively). This shows that children from the North east and west which are mostly from Hausa background had higher prevalence of cough compared to children from Igbo and Yoruba background from the South east and South west. The distributions of child cough infection among child individual characteristics shows that children between the age of 2 and 3 had higher prevalence, while there is no much difference between gender.

## **4.2 Probit Regression of the Relationship between Child Respiratory Disorder and Mothers' Education**

Tables 2 and 3 presents the Bivariate and multivariate Probit regression results of the relationship between child respiratory disorder and mother's level of education. The bivariate regression analysed the relationship between child respiratory disorder indicator and mothers' level of education. The multivariate probit regression analysed: the relationship between child respiratory disorder symptoms and household socioeconomic status and the relationship between child respiratory disorder and mothers' level of education with the inclusion of necessary covariate as control variable. The analysis with the necessary covariate forms the basis for causal relationship which is represented by model 3 and 6.

Table 2 presents results analysed from model 1 to model 3. Model 1 analyzed the relationship between child respiratory disorder indicator and mothers' level of education without any covariate. The result shows that mothers' having primary certificate are 0.030 percentage point less likely to have children with respiratory disorder compared to mothers with no education. Mothers with secondary and tertiary certificates are 0.038 and 0.089 percentage point less likely to have children with fever and cough compared to children whose mothers have no education. Those statistical values are significant at 5% level. Model 2 included wealth index and place of residence as control variable. That did not reduce the coefficient, but the level of significant for children whose mothers had primary and secondary education. Model 2 shows that children from poorer households were 0.002 percentage point less likely to have children with fever and cough compared to children from poorest household, but the difference is not significant. Children from middle, richer and richest household are 0.041 0.052 and 0.16 percentage point respectively less likely to have children with cough and fever compared to children from the poorest household. While, the coefficient of -0.055 on urban implies that children residing in the urban area have lower tendency of 0.055 percentage point of having respiratory tract disorder compared to the children in the rural areas.

**Table 1. Percentages and frequency distribution of child respiratory disorder by mothers' educational level and individual characteristics**

|                                   | Fever        |               |                             | No fever     |               |                             |
|-----------------------------------|--------------|---------------|-----------------------------|--------------|---------------|-----------------------------|
|                                   | Frequency(f) | Percentage(%) | Chi-Square(x <sup>2</sup> ) | Frequency(f) | Percentage(%) | Chi-Square(x <sup>2</sup> ) |
| <b>Child Fever Status</b>         |              |               |                             |              |               |                             |
| <b>Mother's educational level</b> |              |               |                             |              |               |                             |
| None                              | 1,964        | 25.67         | 288.1728                    | 5,688        | 74.33         | 288.1728                    |
| Non Formal                        | 1,758        | 31.98         |                             | 3,739        | 68.02         |                             |
| Primary                           | 1,051        | 22.69         |                             | 3,601        | 77.41         |                             |
| Secondary                         | 1,739        | 21.79         |                             | 6,240        | 78.21         |                             |
| Higher                            | 370          | 16.56         |                             | 1,864        | 83.44         |                             |
| <b>Wealth</b>                     |              |               |                             |              |               |                             |
| Poorest                           | 1,772        | 28.26         | 201.2468                    | 4,498        | 71.74         | 201.2468                    |
| Second                            | 1,707        | 27.51         |                             | 4,499        | 72.49         |                             |
| Middle                            | 1,333        | 24.70         |                             | 4,064        | 75.30         |                             |
| Fourth                            | 1,184        | 22.76         |                             | 4,017        | 77.24         |                             |
| Richest                           | 887          | 17.94         |                             | 4,056        | 82.06         |                             |
| <b>Place of residence</b>         |              |               |                             |              |               |                             |
| Rural                             | 5,368        | 26.10         | 98.0644                     | 15,199       | 73.90         | 98.0644                     |
| Urban                             | 1,515        | 20.34         |                             | 5,935        | 79.66         |                             |
| <b>Child age</b>                  |              |               |                             |              |               |                             |
| 0                                 | 373          | 13.60         | 214,5939                    | 2,370        | 86.40         | 214,5939                    |
| 1                                 | 688          | 25.55         |                             | 2,005        | 74.45         |                             |
| 2                                 | 1,477        | 26.86         |                             | 4,022        | 73.14         |                             |
| 3                                 | 1,477        | 26.93         |                             | 3,991        | 73.07         |                             |
| 4                                 | 1,471        | 25.40         |                             | 4,412        | 74.60         |                             |
| 5                                 | 1,502        | 24.04         |                             | 4,334        | 75.96         |                             |
| <b>Ethnicity</b>                  |              |               |                             |              |               |                             |
| Hausa                             | 4,068        | 30.08         | 468,4283                    | 9,455        | 69.92         | 468,4283                    |
| Igbo                              | 632          | 19.86         |                             | 2,550        | 80.14         |                             |
| Yoruba                            | 410          | 14.85         |                             | 2,351        | 85.15         |                             |
| Others                            | 1,773        | 20.73         |                             | 6,778        | 79.27         |                             |
| <b>Household head sex</b>         |              |               |                             |              |               |                             |

| <b>Child Fever Status</b> |                     |                      |                                  |                     |                      |                                  |
|---------------------------|---------------------|----------------------|----------------------------------|---------------------|----------------------|----------------------------------|
|                           | <b>Fever</b>        |                      |                                  | <b>No fever</b>     |                      |                                  |
|                           | <b>Frequency(f)</b> | <b>Percentage(%)</b> | <b>Chi-Square(x<sup>2</sup>)</b> | <b>Frequency(f)</b> | <b>Percentage(%)</b> | <b>Chi-Square(x<sup>2</sup>)</b> |
| Female                    | 3,340               | 24.15                | 2.6045                           | 10,492              | 75.85                | 2.6045                           |
| Male                      | 3,543               | 24.98                |                                  | 10,642              | 75.02                |                                  |
| <b>Geopolitical zones</b> |                     |                      |                                  |                     |                      |                                  |
| North East                | 1,367               | 28.97                | 522.3659                         | 3,351               | 71.03                | 522.3659                         |
| North West                | 2,915               | 30.68                |                                  | 6,587               | 69.32                |                                  |
| North Central             | 983                 | 18.45                |                                  | 4,346               | 81.55                |                                  |
| South East                | 489                 | 20.55                |                                  | 1,890               | 79.45                |                                  |
| South South               | 684                 | 21.63                |                                  | 2,479               | 78.37                |                                  |
| South West                | 445                 | 15.21                |                                  | 2,481               | 84.79                |                                  |

Source: Owner's computation

**Table 2. Probit regression result for child respiratory disorder and mothers' education**

|                           | Model 1   |          | Model 2    |          | Model 3   |          |
|---------------------------|-----------|----------|------------|----------|-----------|----------|
| Indicators                |           |          |            |          |           |          |
| <b>Mothers education</b>  |           |          |            |          |           |          |
| No Education              |           |          |            |          |           |          |
| Non-Formal                | 0.060***  | (0.0079) | 0.060***   | (0.0079) | 0.023***  | (0.0082) |
| Primary                   | -0.030*** | (0.0077) | -0.021*    | (0.0081) | 0.008     | (0.0090) |
| Secondary                 | -0.038*** | (0.0066) | -0.015*    | (0.0081) | 0.025**   | (0.0091) |
| Tertiary                  | -0.089*** | (0.0088) | -0.051***  | (0.0118) | -0.010    | (0.0134) |
| <b>Wealth index</b>       |           |          |            |          |           |          |
| Poor                      |           |          | -0.0006    | (0.0076) | 0.012     | (0.0078) |
| Middle                    |           |          | -0.0130    | (0.0083) | 0.011     | (0.0088) |
| Rich                      |           |          | -0.0161*   | (0.0095) | 0.016     | (0.0104) |
| Richest                   |           |          | -0.0481*** | (0.0111) | -0.016    | (0.0121) |
| <b>Place of residence</b> |           |          |            |          |           |          |
| Urban                     |           |          | -0.0173*   | (0.0072) | -0.017*   | (0.0076) |
| Zone                      |           |          |            |          |           |          |
| North West                |           |          |            |          | -0.008    | (0.0080) |
| North Central             |           |          |            |          | -0.763*** | (0.0083) |
| South East                |           |          |            |          | -0.046*   | (0.0182) |
| South South               |           |          |            |          | -0.033**  | (0.0113) |
| South West                |           |          |            |          | -0.075*** | (0.0136) |
| <b>Ethnicity</b>          |           |          |            |          |           |          |
| Igbo                      |           |          |            |          | -0.444**  | (0.0164) |
| Yoruba                    |           |          |            |          | -0.067*** | (0.0139) |
| Other Ethnic              |           |          |            |          | -0.048*** | (0.0081) |
| <b>Child age</b>          |           |          |            |          |           |          |
| 1                         |           |          |            |          | 0.157***  | (0.0151) |
| 2                         |           |          |            |          | 0.173***  | (0.0130) |
| 3                         |           |          |            |          | 0.176***  | (0.0130) |
| 4                         |           |          |            |          | 0.157***  | (0.0130) |
| 5                         |           |          |            |          | 0.142***  | (0.0130) |
| <b>Child sex</b>          |           |          |            |          |           |          |
| Male                      |           |          |            |          | 0.009*    | (0.0052) |
| <b>Immunization</b>       |           |          |            |          |           |          |
| Bcg                       |           |          |            |          | -0.025*** | (0.0061) |

*Source: Owner's Computation*

Model 3 contains analysis with necessary covariates as control variables and also the model that present causality of dependent variables. Inclusion of other variables like place of residence, BCG immunization, child age and sex, geopolitical zone and wealth, changed the direction of relationship between mothers' level of education and child respiratory disorder except for children whose mothers had tertiary education. The coefficient on geopolitical zone shows that children who reside in the North west, North central, south east, south south and south west are 0.008, 0.076, 0.046, 0.032, and 0.075 percentage point respectively less likely to have respiratory disorder. The coefficients are statistically significant at 1% level except for the coefficient on north central which is significant at

5%. The coefficient on urban increase from 0.017 to 0.055 percentage point, this implies that place of residence is an important determinant of child cough. The coefficient on ethnicity shows that child whose mother is Igbo, Yoruba or other Nigerian language is 0.044, 0.067 and 0.048 percentage point respectively less likely to suffer from fever and cough compared to a child from Hausa background, all are significant at less than 1%. Children who took BCG immunization were found to be 0.025 percentage point less likely to be at risk of respiratory tract disorder. Also, increase in age of a child and being a male child increase the risk of respiratory disorder.

Model 4 to 6 present analysis of the relationship between a severe case of cough where a child

finds it difficult to breath and mothers' level of education. Model 4 estimate child cough with difficulty of breathing with mother's level of education without any control variable. The trend follow model 1 with coefficients on primary, secondary and tertiary education to be -0.062, -0.118, -0.126 percentage point which are significant at less than 1%. This implies a negative relationship between child cough and mothers' level of education. Model 5 included wealth index and place of residence as control variable. Level of education and wealth still show a significant negative relationship to child

respiratory disorder, while place of residence with coefficient -0.012 percentage point is not significant. Model 6 is the model that analysed the causal relationship between severe child cough and mothers' level of education. The regression results show that mothers' education and wealth index are not causal factors to child severe cough. The causal factors are residing in northwest and east, having mother from Hausa background and not having BCG immunization. This is because the coefficients on these variables are significant below 5% level.

**Table 3. Probit regression result for child respiratory disorder and mothers' education**

|                           | Model 4            | Model 5            | Model 6            |
|---------------------------|--------------------|--------------------|--------------------|
| <b>Indicators</b>         |                    |                    |                    |
| <b>Mothers education</b>  |                    |                    |                    |
| No Education              |                    |                    |                    |
| Non-Formal                | 0.063** (0.0206)   | 0.065** (0.0207)   | 0.059** (0.0220)   |
| Primary                   | -0.062** (0.0208)  | -0.036 (0.0222)    | 0.021 (0.0241)     |
| Secondary                 | -0.119*** (0.0170) | -0.064** (0.0212)  | 0.015 (0.0238)     |
| Tertiary                  | -0.127*** (0.0236) | -0.048 (0.0314)    | 0.026 (0.0352)     |
| <b>Wealth index</b>       |                    |                    |                    |
| Poor                      |                    | -0.018 (0.0206)    | -0.004 (0.0210)    |
| Middle                    |                    | -0.046* (0.0222)   | -0.007 (0.0235)    |
| Rich                      |                    | -0.076** (0.0240)  | -0.015 (0.0262)    |
| Richest                   |                    | -0.109*** (0.0279) | -0.034 (0.0310)    |
| <b>Place of residence</b> |                    |                    |                    |
| Urban Zone                |                    | -0.125 (0.0181)    | -0.011 (0.0195)    |
| North West                |                    |                    | -0.072*** (0.0192) |
| North Central             |                    |                    | -0.099*** (0.0223) |
| South East                |                    |                    | -0.178*** (0.0405) |
| South South               |                    |                    | -0.198*** (0.0235) |
| South West                |                    |                    | -0.296*** (0.0246) |
| <b>Ethnicity</b>          |                    |                    |                    |
| Igbo                      |                    |                    | -0.019 (0.0448)    |
| Yoruba                    |                    |                    | 0.034 (0.0439)     |
| Other Ethnic              |                    |                    | 0.014 (0.0221)     |
| <b>Child age</b>          |                    |                    |                    |
| 1                         |                    |                    | -0.024 (0.0320)    |
| 2                         |                    |                    | -0.022 (0.0284)    |
| 3                         |                    |                    | -0.036 (0.0283)    |
| 4                         |                    |                    | -0.055* (0.0279)   |
| 5                         |                    |                    | -0.074** (0.0280)  |
| <b>Child sex</b>          |                    |                    |                    |
| Male                      |                    |                    | 0.009 (0.0140)     |
| <b>Immunization</b>       |                    |                    |                    |
| Bcg                       |                    |                    | -0.038* (0.0160)   |

Source: Owner's Computation

## 5. DISCUSSION

This study determines the relationship between child respiratory disorder and mothers' level of education. Four key results are discussed: the raw association between measure of under-five age respiratory disorder (cough and difficulty breathing when having cough) and determining variables; relationship between measures of child respiratory disorder and mothers' level of education; relationship between measures of child respiratory disorder and mothers' level of education using wealth and place of residence as control variables and the causal relationship between child respiratory disorder and mothers' level of education controlling for all the necessary covariates.

The descriptive statistics result agrees with the bivariate Probit regression, presenting a negative association between mothers' level of education and the prevalence of respiratory disorder in under five age children in Nigeria. It implies that the prevalence of child respiratory disorder decreases with increased level of mothers' education. The negative relationship between child respiratory disorder and mothers' level of education is also maintained in multivariate Probit regression with the inclusion of wealth index and place of residence. This result is consistent with previous findings [5,15,16,9]. The reason behind this relationship could be that: mothers' who are highly educated tend to have high paying jobs, live in urban centres, good housing conditions and are knowledgeable about preventive measures of child respiratory disorder. In another word, these mothers have the financial ability to provide for their children nutritional and medical needs, accommodate them in conducive environment free of disease-causing mechanisms and have the knowledge of preventing them from respiratory disorder.

In contrast, there is no causal relationship between child respiratory disorder and mothers' level of education after controlling for necessary covariates. The finding of this result conforms to the finding of (Solomon, Odu, Amu, Solomon, Bamidele, Emmanuel, Adetokunbo and Parakoyi, 2018) [17]. This shows that there are stronger pathways through which mothers' level of education affect child respiratory disorder. The significant level on the coefficient of place of residence and immunization in multivariate regression could portray that these pathways include environmental and cultural factors. Since, the clinical causes of respiratory disorder are

mostly airborne, the environment where child lives is a great determinant [18,19]. The result also shows that lack of immunization against respiratory diseases is an important causal factor.

Results from the descriptive statistics and the multivariate Probit regressions also uncover the effects of other important determinants of child respiratory disorder. While, wealth is negatively associated with child respiratory disorder conforming to the findings of [7,13]. The strength of this relationship disappeared with the inclusion of variables like place of residence, ethnicity and immunization [20-22]. The association between wealth index and child respiratory disorder shows that, the prevalence of child respiratory disorder is higher among children from lower income households. This is possible because children from richer households have advantage in terms conducive environment, better access to health care, better diet, better clothing to protect them against cold and parent's preventive effort against child disease.

Place of residence was found to be an important determinant of under-five respiratory disorder all through the data analysis. The descriptive and regression results show a strong negative relationship between children residing in the urban centres and the risk of respiratory disorder. This result is consistent with the finding of [5]. Urban infrastructure increases the availability of schools, health care facilities, improved environmental condition and availability of food. All these factors places an urban dwelling child on an added advantage compared to a rural child. For instance, a woman who grows up in an urban area have the chance of attending a good school that will improve her cultural, physical, nutritional knowledge, health knowledge and technical skills; the financial ability to afford quality care for her children and also enjoy the proximity to well-equipped health centre. A child from such mother will tend to enjoy better health not only with respect to respiratory disorder, but other child diseases.

Ethnicity and geopolitical zone were also found to be important determinants of child respiratory disorder. Children residing in geopolitical zones other than the Northeast tend to have less prevalence of respiratory disorder which agrees with ethnicity. This finding is consistent with the result of [7]. Mothers from Hausa speaking background mostly residing in the North had children with high prevalence of respiratory

disorder. The poor infrastructural development and poverty status are the main causes to place children from these regions at disadvantage and liable to child diseases such as respiratory disorder [23-25]. BCG immunization was also found to impact child respiratory disorder negatively because it provides protection against the disease which agrees to previous studies [14].

## 6. CONCLUSION

Over the years, Nigeria has experienced high rate of under-five mortality rate majorly due to preventable child diseases of which child respiratory disorder is a key factor. Nigeria is not only among the highest countries in Africa but the world with high rate of child respiratory disorder. This paper therefore, uses Nigeria Multiple Indicators Cluster Survey (MCIS) 2017 data to examine the impact of mothers' educational level on children respiratory disorder. Descriptive statistics through chi-square, bivariate and multivariate probit regression was used to achieve the objective of the study.

Mothers' level of education was found to be a key determinant of child respiratory disorder independent of control covariates such as place of residence, ethnicity and immunization. The results from the inclusion of these necessary control variables shows that mothers' level of education is not a causal determinant of child respiratory disorder but a confounding factor. This implies that mothers' level of education impact child respiratory disorder negatively through mechanisms such as: place of residence; ethnicity and immunization. Therefore, place of residence, ethnicity, BCG immunization and geopolitical zone impact child respiratory status directly. Mother's level of education decides her socioeconomic status which in turn determines her place of residence. This place of residence captures environmental factors that affect child ill health especially respiratory disorder. Educational level of mother also improves her knowledge about child health care prevention which immunization is a key component.

Therefore, this paper recommends practical steps to be taken by Government to improve on girl child education. Some of these steps could include: compulsory free education for a girl child at least to secondary school level and improving quality of education in government primary and

secondary schools by employing qualified teachers and payment of attractive salaries. Government should also intensify preventive child health care awareness especially among rural mothers through primary health care workers. Effort to achieve Sustainable Development Goal (SDG) before 2030 should be holistic and comprehensive. Some of these goals include reduction of under-five mortality rate characterized by poverty, economic and environmental development. Proactive measures should also be taken by government to build well equipped health care facilities in rural areas to increase access to health care.

## COMPETING INTERESTS

Authors have declared that no competing interests exist.

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