# Environmental and Socioeconomic Determinants of Child Mortality: Evidence from the 2013 Nigerian Demographic Health Survey

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**Abstract**  Despite the global decline in under-five mortality rate from 91 deaths per 1000 live births in 1990 to 43 deaths per 1000 live births in 2015 and Nigeria's under-five mortality reduction from 201 per 1,000 live births in 2009 to 128 per 1,000 live births in 2013 as against the Sustainable Development Goal target of 25 per 1,000 live births, child mortality rate still remain unacceptably high in Nigeria and thereby has a long way to go in achieving this target. This study explores the household's environmental, socio-economic characteristics, maternal demographic and their effect on child mortality. Data from the Nigeria Demographic and Health Survey (NDHS) 2013 was used to investigate the predictors of child (aged 0-4 years) mortality in Nigeria. Data for the currently married women who had experienced child mortality and those who have not, totaling 20,192. Cross-tabulation and binary logistic regression techniques were employed in the statistical analysis. The result indicated that child mortality rate was highest (46.0%) among mothers with no educational and lowest (13.6%) among mothers with tertiary education and was statistically significant in reducing the child mortality rate. Children born in households with unimproved toilet experienced highest mortality rate (41.0%) compared to those who were born in households with improved toilet (30.4%) and have substantial impact on child mortality. Maternal education and provision of sanitation facilities should be advocated as a strategy to reduce child mortality.

*Keywords: environmental determinant, child mortality, socio-economic determinant, wealth index, Nigeria Demographic and Health Survey (NDHS)*

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## 1. Introduction

Child mortality is a fundamental measurement of a country's level of socio-economic development as well as the quality of life especially of the mothers. Child mortality reduction has become a common agenda of public health and international development agencies in recent time [1]. Globally, under-five mortality rate has decreased by 53%, from an estimated rate of 91 deaths per 1000 live births in 1990 to 43 deaths per 1000 live births in 2015 [2], majorly due to interventions activities targeted at communicable diseases such as malaria, measles, diarrhoea, respiratory infections and other immunizable childhood infections which have been major causes of child mortality. Previous study had revealed an annual global decline of 2.2% in childhood mortality between 1990 and 2010 [3]. It should be noted that these health gains were short lived especially in sub-Sahara Africa because disease oriented vertical program alone were ineffective [1]. Environmental, maternal and socio-economic factors were acknowledged as additional important determinants of child survival [4].

Past studies have shown that half of childhood deaths take place in sub-Saharan Africa despite the region having only one fifth of the world's children population [5,6]. In fact, previous reports in sub-Saharan Africa have shown that a child in 8 dies before age five - nearly 20 times the average of 1 in 167 in the developed world [7]. With the end of the Millennium Development Goal (MDG) era, the international community is in the process of agreeing on a new framework – the Sustainable Development Goals (SDGs) where the target is to end preventable deaths of newborns and children under 5 years of age.

It should be noted that child mortality rate still remain unacceptably high in Nigeria and other developing countries in spite of various action plans and intervention activities by governmental and non-governmental organizations. In a local study conducted among under-five children attending a private hospital in Kano, Ogunjuyigbe [8] viewed morbidity and mortality of the

child to be influenced by the certain underlying biological and socio-economic factors that operates through proximate determinants. Furthermore, Mutunga [9] reported that among the ten identified leading mortality risks developing countries; unsafe water, sanitation and hygiene as well as smoke from solid fuels ranked among the most threatening.

Mesike and Mojekwu [6] reported that about 3% (1.7 million) of the resulting deaths are attributable to environmental risk factors and child deaths account for about 90% of the total deaths. Information on both personal, environmental and background characteristics could provide insight into proximate factors associated with child mortality and ultimately inform evidence-based interventions. This study explores the household's environmental, socio-economic characteristics, maternal demographic and their effect on child mortality using 2013 Nigeria Demographic and Health Survey (NDHS). Findings from the study would be useful to public health researchers and policy makers in reviewing and designing new community based intervention strategies aimed at reducing child mortality in Nigeria.

## 2. Materials and Methods

### 2.1. Study Area

Nigeria lies between latitudes 4º16' and 13º53' North and longitudes 2º40' and 14º41' East in the West African sub-region of sub-Saharan Africa. It shares borders with Niger in the north, Chad in the northeast, Cameroon in the east, and Benin in the west and in the south by approximately 850 kilometres of Atlantic Ocean, stretching from Badagry in the west to the Rio del Rey in the east [10]. According to the 2006 population and housing census, Nigeria's population was 140,431,790 with a national growth rate of 3.2% per annum [10]. The country is the most populous in Africa and the sixth largest in the world after China, India, USA, Indonesia and Brazil. Politically, Nigeria is made up of 36 states and a Federal Capital Territory. The 36 states are grouped into six geo-political zones (regions) namely: North West, North East, North Central, South East, South West and South South. The level of urbanisation is about 45%, but is growing at an estimated rate of 5.3% per year. Fertility has remained high with a Total Fertility Rate (TFR) of 5.7 since 2003.

### 2.2. Source of Data and Data Extraction

The study used data from the Nigeria Demographic and Health Survey (NDHS) 2013 [11]. The 2013 NDHS is the fifth comprehensive survey conducted in Nigeria as part of the Demographic and Health Surveys (DHS) programme. The dataset is a nationally representative cross-sectional data collected through face-to-face interviews among 38,948 women age 15-49 in 2013. The sampling technique followed a stratified two-stage cluster procedures. The data provide information on levels and trends in fertility; nuptiality; sexual activity; fertility preferences; awareness and use of family planning methods; infants and young children feeding practices; nutritional status of mothers and young children; early childhood mortality and maternal mortality; maternal and

child health; and awareness and behaviour regarding HIV/AIDS and other sexually transmitted infections.

For this study, data were extracted for a total of 20,192 women who participated in the nationwide demographic and health survey (DHS). The targeted respondents in this study were currently married women who had experienced child mortality and those who have not. Childhood mortality estimates were based on information from women's birth histories collected from a special survey questionnaire (called the women questionnaire) for women who participated in the survey. Women were asked questions about their total number of children ever born and surviving as well as detailed reproductive history including sex and date of every live birth, child survival status at time of interview, current age of surviving children and age at death (for dead children).

### 2.3. Definition of Extracted Variables

Data was extracted for the following the set of variables selected based on the analytical framework and empirical evidence described in previous studies [12,13].

### 2.4. Socio-economic/Background Characteristics

The socio-economic characteristics studies in the present analysis included geopolitical region of residence (defined as North-east, North-west, North-central, South-east, South-west and South-south), mother's education (defined as no formal education, primary, secondary and higher. The same categorization was made for the spouse. possession of electricity (a yes/no response to whether the household has electricity or not), possession of radio (a yes/no response to whether the household has radio or not), possession of Television (a yes/no response to whether the household has television or not), maternal wealth status (was recoded as rich, average and poor from its original 5 categories), occupation of the mother (categorized as working and non-working), religion (broadly categorized as Christian, Islam and others) and place of residence (the location where mother/ children live was categorized as rural or urban).

### 2.5. Proximate Factors

Relevant proximate determinants of child mortality analyzed in the present study included breastfeeding (defined as whether the mother breastfeed the child for at least 6 months during infancy), maternal age (this is the present age of the mother categories as < 20 years, <30 years and 30+ years), maternal age at first birth (is the age of the mother at the first child bearing categorized as ≤17 years, 18-25 years and 26+ years), visited Health facility (describing whether or not the mother visited health facility in the last 12months), family size (defined by the number of children born by the mother in the family was categorized as small- ≤4 children, medium- 5-7 children and large- 8+ children) and possession / use of bed net.

### 2.6. Environmental Factors

The environmental factors relate to variables associated with sanitation and hygiene including source of drinking water (recoded as safe and unsafe), households' cooking fuel (categorized as low-polluting fuel and high-polluting fuel), wall materials (categorized as finished, rudimentary

and natural), roofing materials (categorized as finished, rudimentary and natural), time to source for the water (defined as time required to get to the source of water used by the household. This was categorized as ≤30 minutes, and > 30 minutes), toilet facilities (categorized as improved toilet, unimproved and no facility), toilet shared by the household (indicating a yes/no response to whether the household shared their toilet with other households) and flooring materials (categorized as finished, rudimentary and natural).

## 2.7. Ethical Considerations

Formal approval to use the data was obtained from ORC Macro International, the agency responsible for the worldwide Demographic and Health Surveys. Oral and written informed consent was sought from each respondent before a questionnaire was administered. The retrieved NDHS data was in anonymous format as identifying information was not collected during the survey.

## 2.8. Data Management and Analysis

The outcome variable is the occurrence of under-five mortality, derived from the difference between total children ever born (CEB) in the last five year and number of living children aged 0-4 years. A variable indicating experience of under-five mortality was coded zero (0) (for women who have never lost any under-five child) and one (1) for women who have experienced under-five mortality. Descriptive statistics were generated to describe categorical variables while associations between child mortality and socio-economic, demographic, maternal health care and environmental variables were tested using chi-square test. Binary logistic regression analysis was used to assess adjusted association of each variable while controlling for others important independent variables. All analyses were performed at 5% significance level using SPSS version 20.

## 3. Results and Discussions

The distributions of socio economic, demographic and proximate variables influencing child mortality as observed from the result of the analysis (Table 1) showed maternal education has a strong relationship with child mortality. The result indicated that child mortality rate was highest (46.0%) among mothers with no educational background and lowest (13.6%) among mothers with tertiary education (Table 1). The odds of experiencing child mortality was 73% higher in women without education and 30% in women with secondary education compared to those with tertiary educational background (Table 2). Thus, child mortality rate decreases as mother's education increases. This is consistent with the findings of Chowdhury *et al.,* [14] and Iyun, [15], that child mortality is higher among women with primary education and lower among women with higher education. Several studies have supported direct causal relationship between mother's education and child mortality in which it plays a major role in the decline of infant and child mortality, presumably reflecting personal health behaviour, care and access to and use of health services [16,17]. Educated women tend to marry late, delay childbearing and more likely to practice family planning, free from traditional values, which leads to changes in behavioural patterns, attitude and improved welfare of the child [18,19].

**Table 1. Univariate analysis of child mortality with background and proximate variables**

| Variables | Is Child alive? | | $\chi^2$ |
|---|---|---|---|
| | Yes (%) | N0 (%) | |
| **Age** | | | |
| < 20 | 1089 (85.9%) | 179 (14.1%) | |
| 20-29 | 6862 (74.7%) | 2326 (25.3%) | 1221.0[**] |
| 30+ | 5132 (53.1%) | 4528 (46.9%) | |
| **Age at first birth** | | | |
| ≤ 17 | 4197 (54.1%) | 3556 (45.9%) | |
| 18-25 | 7294 (70.0%) | 3120 (30.0%) | 757.5[**] |
| 26+ | 1592 (81.7%) | 357 (18.3%) | |
| **Maternal's level of education** | | | |
| None | 4915 (54.0%) | 4189 (46.0%) | |
| Primary | 2593 (63.2%) | 1513 (36.8%) | 1266.0[**] |
| Secondary | 4415 (79.4%) | 1148 (20.6%) | |
| Higher | 1160 (86.4%) | 183 (13.6%) | |
| **Spouse's level of education** | | | |
| None | 3869 (53.6%) | 3348 (46.4%) | |
| Primary | 2244 (60.6%) | 1458 (39.4%) | 826.6[**] |
| Secondary | 4307 (74.5%) | 1476 (25.5%) | |
| Higher | 2065 (76.8%) | 623 (23.2%) | |
| **Wealth Index** | | | |
| Low | 4805 (53.9%) | 4106 (46.1%) | |
| Average | 2729 (67.2%) | 1335 (32.8%) | 996.2[**] |
| High | 5549 (77.7%) | 1592 (22.3%) | |
| **Religion** | | | |
| Christian | 6123 (73.3%) | 2225 (26.7%) | 442.3[**] |
| Islam | 6785 (59.2%) | 4678 (40.8%) | |
| Others | 109 (51.7%) | 102 (48.3%) | |

**Location**

| | | | |
|---|---|---|---|
| *Urban* | 5078 (74.9%) | 1705 (25.1%) | 434.0[**] |
| *Rural* | 8005 (60.0%) | 5327 (40.0%) | |

**Occupation**

| | | | |
|---|---|---|---|
| *Not Working* | 4046 (69.1%) | 1808 (30.9%) | 59.55[**] |
| *Working* | 8983 (63.4%) | 5186 (36.6%) | |

**Region**

| | | | |
|---|---|---|---|
| *North Central* | 2351 (76.0%) | 743 (24.0%) | |
| *North East* | 2278 (57.2%) | 1707 (42.8%) | |
| *North West* | 3311 (53.8%) | 2840 (46.2%) | 915.02[**] |
| *South East* | 1207 (70.1%) | 515 (29.9%) | |
| *South South* | 1899 (76.0%) | 599 (24.0%) | |
| *South West* | 2037 (76.4%) | 629 (23.6%) | |

**Family Size**

| | | | |
|---|---|---|---|
| *Small* | 10160 (81.1%) | 2367 (18.9%) | |
| *Medium* | 2479 (47.8%) | 2711 (52.2%) | 4387.35[**] |
| *Big* | 444 (18.5%) | 1955 (81.5%) | |

**Have mosquito net for sleeping**

| | | | |
|---|---|---|---|
| *No* | 4640 (68.3%) | 2156 (31.7%) | 47.63[**] |
| *Yes* | 8735 (63.4%) | 4876 (36.6%) | |

**Visited health facility in the last 12 months**

| | | | |
|---|---|---|---|
| *No* | 8505 (61.6%) | 5305 (38.4%) | 238.0[**] |
| *Yes* | 4523 (72.8%) | 1688 (27.2%) | |

**Breastfeeding**

| | | | |
|---|---|---|---|
| *No* | 6420 (62.0%) | 3939 (38.0%) | 88.10[**] |
| *Yes* | 6663 (68.3%) | 3094 (31.7%) | |

**Household drinking water source**

| | | | |
|---|---|---|---|
| *Safe* | 8159 (68.9%) | 3691 (31.1%) | 197.00[**] |
| *Unsafe* | 4780 (59.2%) | 3296 (40.8%) | |

**Time to get drinking water**

| | | | |
|---|---|---|---|
| *On premise* | 2598 (65.4%) | 1374 (34.6%) | |
| *≤30minutes* | 8362 (65.6%) | 4343 (34.4%) | 25.21[**] |
| *>30minutes* | 1815 (60.8%) | 1170 (39.2%) | |

**Toilet Facility**

| | | | |
|---|---|---|---|
| *Improved* | 5237 (69.6%) | 2286 (30.4%) | |
| *Unimproved* | 3700 (59.0%) | 2572 (41.0%) | 170.00[**] |
| *No facility* | 3989 (65.3%) | 2120 (34.7%) | |

**Toilet shared with other households**

| | | | |
|---|---|---|---|
| *No* | 5481 (60.3%) | 3615 (39.7%) | 238.00[**] |
| *Yes* | 3446 (73.5%) | 1242 (26.5%) | |

**Type of Cooking fuel**

| | | | |
|---|---|---|---|
| *Low Polluting fuel* | 2978 (81.5%) | 678 (18.5%) | 537.20[**] |
| *High Polluting fuel* | 9944 (61.2%) | 6302 (38.8%) | |

**Flooring material**

| | | | |
|---|---|---|---|
| *Finished* | 8125 (71.9%) | 3180 (28.1%) | |
| *Rudimentary* | 94 (59.9%) | 63 (40.1%) | 547.50[**] |
| *Natural* | 4687 (55.8%) | 3710 (44.2%) | |

**Roofing material**

| | | | |
|---|---|---|---|
| *Finished* | 2211 (57.3%) | 1651 (42.7%) | |
| *Rudimentary* | 692 (50.0%) | 693 (50.0%) | 313.60[**] |
| *Natural* | 10020 (68.4%) | 4630 (31.6%) | |

**Wall material**

| | | | |
|---|---|---|---|
| *Finished* | 4773 (56.1%) | 3736 (43.9%) | |
| *Rudimentary* | 757 (57.0%) | 571 (43.0%) | 657.00[**] |
| *Natural* | 7378 (73.6%) | 2651 (26.4%) | |

**Electricity**

| | | | |
|---|---|---|---|
| *No* | 6109 (58.6%) | 4311 (41.4%) | 384.33[**] |
| *Yes* | 6811 (71.9%) | 2661 (28.1%) | |

**Radio**

| | | | |
|---|---|---|---|
| *No* | 3919 (61.6%) | 2438 (38.4%) | 44.62[**] |
| *Yes* | 9006 (66.5%) | 4538 (33.5%) | |

**Television**

| | | | |
|---|---|---|---|
| *No* | 6505 (57.6%) | 4784 (42.4%) | 618.75[**] |
| *Yes* | 6410 (74.6%) | 2181 (25.4%) | |

**- $P<0.05$.

Similar patterns were observed among the spouses. There was no significant relationship between spouse's educational background and child's mortality and the odds of child mortality was experienced most among father's with primary education (12%) compared to highly educated fathers (Table 1). Father's education plays significant role on child mortality, highest among non-educated fathers and the converse holds for literate fathers. This result showed that child mortality sharply decreases as father's educational level increases. Father's level of education can be regarded as a valid proxy of income and wealth status of households in Nigeria [13].

The highest child mortality rate (36.6%) was found among the children whose mothers were working (Table 1). The incidence of child mortality is expected to be lower among working women than those unemployed since a mother's occupation is usually associated with the nutritional status of their children. Mothers with source of income are able to provide food in the right quantity and quality and other essential needs for their children but reverse is the case in this study, the reason might be due to non-availability of time to cater for their wards. There was a significant relationship between women occupational status and child mortality; the odds of child mortality experienced among women who are working was 82% higher compared to women with no occupation (Table 2).

Child mortality rate (40.0%) was experienced among the children whose mothers also lived in rural area (Table 1). This is in tandem with United Nations Children's Fund report in [19] which said children from rural areas are more vulnerable than their counterparts from the urban. This observation could be considered a reality because mothers in urban area of the country may likely have access to good health facilities, pipe borne water, exposure to information, and other amenities of good living. It should also be noted that the highest child mortality rate (48.3%) was found among the children whose mothers were traditionalists compared to other religion although this relationship was not statistically significant (Table 2). The differences might be attributed to socio-cultural patterns of living, age-long habits, customs, and traditions affecting cleanliness, eating, clothing and child care.

**Table 2. Regression analysis of child mortality with background and proximate variables**

| Variables | OR of Child mortality | 95% CI for OR | |
| --- | --- | --- | --- |
| | | Lower | Upper |
| **Age** | | | |
| *< 20* | 0.445** | 0.347 | 0.570 |
| *20-29* | 0.935* | 0.830 | 1.053 |
| *30+* | - | - | - |
| **Age at first birth** | | | |
| *≤ 17* | 1.848 | 1.523 | 2.242 |
| *18-25* | 1.324 | 1.110 | 1.579 |
| *26+* | - | - | - |
| **Maternal's level of Education** | | | |
| *None* | 1.731** | 1.329 | 2.256 |
| *Primary* | 1.536** | 1.195 | 1.973 |
| *Secondary* | 1.300** | 1.035 | 1.632 |
| *Higher* | - | - | - |
| **Spouse's level of education** | | | |
| *None* | 1.066* | 0.891 | 1.275 |
| *Primary* | 1.115* | 0.934 | 1.330 |
| *Secondary* | 1.026* | 0.876 | 1.200 |
| *Higher* | - | - | - |
| **Wealth Index** | | | |
| *Low* | 1.353** | 1.062 | 1.725 |
| *Average* | 0.988* | 0.830 | 1.175 |
| *High* | RC | | |
| **Religion** | | | |
| *Christian* | 0.856* | 0.491 | 1.492 |
| *Islam* | 0.781* | 0.448 | 1.360 |
| *Others* | - | - | - |
| **Location** | | | |
| *Urban* | 0.749** | 0.665 | 0.844 |
| *Rural* | - | - | - |
| **Occupation** | | | |
| *Not Working* | 0.820** | 0.742 | 0.906 |
| *Working* | - | - | - |
| **Region** | | | |
| *North Central* | 0.569** | 0.455 | 0.712 |
| *North East* | 0.905* | 0.718 | 1.140 |
| *North West* | 0.928* | 0.741 | 1.162 |
| *South East* | 0.809* | 0.643 | 1.019 |
| *South South* | 0.563** | 0.456 | 0.694 |
| *South West* | - | - | - |
| **Family Size** | | | |

| | | | |
|---|---|---|---|
| *Small* | 0.077** | 0.065 | 0.092 |
| *Medium* | 0.286** | 0.245 | 0.333 |
| *Big* | - | - | - |
| **Have mosquito net for sleeping** | | | |
| *No* | 0.896** | 0.815 | 0.985 |
| *Yes* | - | - | - |
| **Visited health facility in the last 12 months** | | | |
| *No* | 1.149** | 1.038 | 1.272 |
| *Yes* | - | - | - |
| **Breastfeeding** | | | |
| *No* | 1.575** | 1.442 | 1.720 |
| *Yes* | - | - | - |
| **Household drinking water source** | | | |
| *Safe* | 0.940* | 0.850 | 1.040 |
| *Unsafe* | - | - | - |
| **Time to get drinking water** | | | |
| *On premise* | 0.979* | 0.842 | 1.138 |
| *≤30minutes* | 1.013 | 0.886 | 1.159 |
| *>30minutes* | - | - | - |
| **Toilet Facility** | | | |
| *Improved* | 0.848** | 0.774 | 0.929 |
| *Unimproved* | - | - | - |
| *No facility* | RC | | |
| **Toilet shared with other households** | | | |
| *No* | 1.017* | 0.913 | 1.133 |
| *Yes* | - | - | - |
| **Type of Cooking fuel** | | | |
| *Low Polluting fuel* | 1.124* | 0.955 | 1.323 |
| *High Polluting fuel* | - | - | - |
| **Flooring material** | | | |
| *Finished* | 0.926* | 0.823 | 1.043 |
| *Rudimentary* | 0.641* | 0.334 | 1.232 |
| *Natural* | - | - | - |
| **Roofing material** | | | |
| *Finished* | 0.903* | 0.780 | 1.046 |
| *Rudimentary* | 1.010* | 0.848 | 1.203 |
| *Natural* | - | - | - |
| **Wall material** | | | |
| *Finished* | 0.993* | 0.863 | 1.142 |
| *Rudimentary* | 1.198* | 0.985 | 1.456 |
| *Natural* | - | - | - |
| **Electricity** | | | |
| *No* | 1.026* | 0.913 | 1.153 |
| *Yes* | - | - | - |
| **Radio** | | | |
| *No* | 1.023* | 0.924 | 1.133 |
| *Yes* | - | - | - |
| **Television** | | | |
| *No* | 1.081* | 0.937 | 1.248 |
| *Yes* | - | - | - |

*- $p > 0.05$, **- $p < 0.05$.

Poverty influences health because it largely determines environmental risks, as well as access to resources to deal with those risks. Wealth index was used to evaluate the influence of social class on health of mother and child. Results from Table 1 showed that children born in households with low standard of living index experienced highest mortality (46.1%) compared to those who were born in households with very high standard of living index. The odds of experiencing child mortality was 35% higher among mothers from low economic class compared with rich mothers which is statistically significant (Table 2).

The availability and quantity of health care and the nature of the child's environment are closely related to socio-economic status. Children from big family experienced 81.5% of mortality compared to ones from the small family size (Table 1) and there is a significant association between family size and child mortality. Child mortality rate tends to be increasing steadily with family size. This is similar to Park, [18] which said that the numbers of episodes of infectious diarrhoea, prevalence of malnutrition and severe respiratory infection have been found to increase with family size. The increase in the child mortality rate with family size may reflect a more intense competition faced in terms of caregivers' time, medical resources, and nutritious food which are required by children.

Age at first birth of mother is another significant factor affecting child mortality indicated in this study. As the age

at first birth increases by respondents, there was reduction in child mortality experienced by adolescent mothers (18.3%) compared to teen mothers (45.9%) in Table 1. The odds of child mortality experienced by teenage mothers was 85% compared to mothers aged 26years and above at first birth (Table 2). This indicated a higher probability of child mortality due to complications in pregnancy and delivery, premature birth and other related causes experienced by teenage mothers coupled with their attitude and care.

Access to electricity, radio and television were used as proxies for access to infrastructure and information. Table 1 revealed that majority of the respondents did not have access to electricity, radio and television and experienced higher rate of child mortality. This is an indication of inadequate infrastructure as well as decreased awareness about child health since households learn about childcare, proper hygiene and sanitation through the various public health programmes on media. Also, the result showed that majority (38.8%) of the respondents cooked with high polluting fuel experienced child mortality though the association was not statistically significant.

Access to good sanitation facilities is believed to reduce morbidity and diarrhoea which is one of the major causes of under-five mortality. Result from Table 1 showed that children born in households with unimproved toilet experienced highest mortality rate (41.0%) compared to those who were born in households with improved toilet (30.4%). This result was consistent with the findings of [20,21] that access to modern sanitation facilities reduces diarrhoeal incidence. Water acts as a medium for waterborne diseases such as diarrhoea, which poses the greatest threat to child survival in Nigeria. As shown in Table 1, greater proportion of the respondents (40.8%) did not have access to safe drinking water and as such were exposed to diseases and infections. The odds of child mortality experienced by households with safe water source was 6% less compared with those with unsafe water source (Table 2). It should be noted that there is no association between drinking water source and child mortality, which corroborates the findings of Younger, [22] on no significant effects of variables related to the quality of drinking water and child mortality.

The odds of experiencing child mortality was 58% higher among mothers who did not breastfeed compared and statistically significant (Table 2). This finding confirmed the findings of [20,23] that breastfeeding has a beneficial effect on the nutritional status, morbidity and mortality of infants. This could be attributed to the fact that breastfeeding contains nutrients and natural immunizing agents which help to combats various infectious diseases and strengthens essential antibody system of the children [18]. Children born in households that visited health facility in the last 12 months experienced lowest mortality (27.2%) compared to those who did not visit (Table 1). The odds of experiencing child mortality was 15% higher among mothers who did not visit health facility in the last 12 months compared with visiting mothers which was statistically significant (Table 2). Proper medical attention and hygienic conditions during delivery can reduce the risk of infections and facilitate management of complications that can cause death or various illnesses for the child [18,23].

# 4. Conclusion

The study revealed that household's environmental, socio-economic characteristics, maternal demographic have been identified as the important factors driving child mortality. Since child mortality is a powerful indicator for measuring the overall health situation of a country, special attention should be given to it as children are not only assets but they are the future of a country. Maternal education should be advocated as a strategy to reduce child mortality. Government should intensify efforts at providing rural infrastructure for instance potable water, modern waste disposal facilities to reduce the risk of exposure to diseases such as malaria and diarrhoea which are the leading causes of child mortality. Also, government should provide more primary healthcare facilities in order to ensure adequate coverage of and accessibility to the health facilities.

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