DETERMINANTS OF MATERNAL USE OF ORAL REHYDRATION SOLUTION (ORS) AND VISIT TO A MEDICAL FACILITY FOR DIARRHEA AMONG UNDER-FIVE CHILDREN IN NIGERIA: A SECONDARY ANALYSIS OF 2013 NIGERIAN DEMOGRAPHIC AND HEALTH SURVEY

BY

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THESIS

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ABSTRACT

Background: Diarrhea is a leading cause of mortality in children under the age of five globally, especially in developing countries. In Nigeria, an estimated 150,000 children under the age of five die each year in Nigeria as a result of diarrhea. Majority of these deaths can be prevented by the prompt use of oral rehydration solution (ORS) and immediate medical attention. Nevertheless, some children do not receive prompt care which sometimes leads to premature deaths.

Objective: This study examines the influence of various maternal factors on the use of ORS and visiting medical facilities during under-five diarrhea episodes.

Methods: Data from the 2013 Nigeria Demographic Health Survey was used for the study, specifically data from the women's questionnaire. The study consisted of women between the ages of 18 and 49 in Nigeria with children under the age of five who had diarrhea two weeks preceding the survey. Data were analyzed using Chi-square tests and logistic regressions to determine relationship between maternal factors and use of ORS and visit to a medical facility to under-five diarrhea episodes.

Results: Bivariate analyses showed that there were statistically significant associations ($p<0.05$) between maternal provision of ORS and visit to a medical facility during under-five diarrhea with the following maternal characteristics: maternal education, place of residence, wealth index. The logistic regressions found that maternal education and place of residence were important determinants of diarrhea management among under-five children. Compared to mothers with no education, mothers with tertiary education or higher were found to be 2.81 times more likely to

give their children ORS than those with no education (OR=2.81, 95% CI: 1.68-4.69). Similarly, Mothers who have higher education were 3.68 times more likely to take their children to a medical facility during diarrhea episode than those with no education (OR=3.68, 95% CI 2.23-6.05).

Conclusion: The findings revealed that maternal educations as well as community level characteristics, such as region and region of residence are important determinants of under-five diarrhea management. Efforts to encourage maternal management of under-five diarrhea episodes should take into account community level factors that can influence maternal under-five diarrhea management practices. This would assist in reducing disparities with under-five health outcomes associated with variations in community level factors such as place of residence and region of residence.

Keywords: Under-five diarrhea, maternal factors, diarrhea management, ORS use, visit to medical facility

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CHAPTER 1
INTRODUCTION

1.1 BACKGROUND

Diarrhea is the second leading cause of death in children under five years globally and accounts for about 760,000 deaths a year among children below five years [1]. In fact, diarrhea kills more children under-five than AIDS, malaria, and measles combined [2].In developing countries diarrheal diseases remain a leading cause of mortality and morbidity of children under the age of five [1]. Specifically, over half of under-five diarrhea deaths occur in just five countries: Nigeria, India, Afghanistan, Pakistan and Ethiopia [3].

Diarrhea which is the passage of three or more loose or liquid stool per is mostly a symptom of infection in the gastrointestinal tract caused by a variety of bacterial, viral, and parasitic organism [1] According to the World Health Organization's (WHO) 2013 report there are three clinical types of diarrhea: acute watery diarrhea, acute bloody diarrhea, and persistent diarrhea [1]. Acute watery diarrhea is the type that lasts several hours or days and include cholera, acute bloody diarrhea is also known as dysentery, while persistent diarrhea is the type that lasts 14 days or longer[1].

In Nigeria an estimated 150,000 children under the age of five die each year in Nigeria as a result of diarrhea. This accounts for over 16% of the deaths among children under-five years of age in the country [4]. Majority of these diarrheal deaths are caused by dehydration. Fluid replacement therapy and timely medical attention for children are important factors to reducing childhood deaths from diarrhea[2]. Oral rehydration solution is considered as the first-line therapy to reduce cases of deaths due to moderate dehydration [5-7] . It is widely recommended

by the WHO because it is simple, inexpensive and has been reported to be an effective way to treat dehydration to reduce diarrhea mortality especially among children[8].

Despite the known benefits of the use of ORS and timely visit to a medical facility in reducing the adverse effects of diarrhea among under-five children, these methods of diarrhea management still needs in improvement [9, 10]. Studies in Nigeria found that the utilization of ORS for under-five diarrhea in Nigeria is quite low[9]. The utilization of diarrhea management practices were found to be influenced by parents of the child [10]. The role of the family, especially mothers is important in health promotion, disease prevention and management, and patient care [11]. Therefore, it is important to understand under-five diarrhea through the mother because a young child's world is predominantly influenced by and experienced through their mothers [12]. Additional, several studies have reported that the extent to which a mother can care and support their children is directed by various familial, social, and cultural factors [12].

1.2 PURPOSE OF THE STUDY

The purpose of this study is to contribute to existing body of literature in assessing the determinants of maternal management of diarrhea. This study will focus on the use of ORT and visit to a medical facility as forms of diarrhea management.

CHAPTER 2
LITERATURE REVIEW

2.1 OVERVIEW OF DIARRHEA

Diarrhea is caused by infectious organisms, including viruses, bacteria, protozoa, and helminths, that are usually transmitted through fecal-oral transmission [13]. It is the leading cause of morbidity and mortality in under-five children in developing countries [2, 3, 14] Three major diarrhea syndromes exist: a) acute watery diarrhea, b) persistent diarrhea, and c) bloody diarrhea[1, 13]. These types of diarrhea vary physiologically and require different management measures [13].

Acute watery diarrhea is often associated with various degree of dehydration [13]. The degree of dehydration is rated on a scale of three: a) early dehydration, b) moderate dehydration , and c) severe dehydration [1].With early dehydration there is usually no signs or symptoms, Severe dehydration is usually caused by rotavirus , enterotoxigenic *E. coli* (causes), or *V. cholera* (causes cholera) [13]. These form of excessive dehydration is very problematic among young children especially does under the age of five [1]. Acute diarrhea often lasts several hours or days and the management for this type of diarrhea is usually focused on preventing dehydration [1, 13].

Persistent diarrhea is heavily associated with malnutrition and it occurs more often during an episode of bloody diarrhea than during an episode of acute watery diarrhea. Management for this type of diarrhea is usually focused on overcoming the nutritional alterations caused by the illness [13]. “Undernourished children and those with illnesses, such as AIDS, are more likely to develop persistent diarrhea” [4].

Bloody diarrhea is a type of diarrhea characterized with visible microscopic blood in the stool [13]. This is often referred to as dysentery and associated with intestinal damage and loss of nutrient among infected individuals[4, 15].

2.2 BURDEN OF DIARRHEA

Globally there are approximately 1.7 billion cases of diarrheal diseases each year [1]. Diarrhea diseases account for an estimated 3.6% of the total global burden of diseases [16].Children are more at risk to severe dehydration resulting from diarrhea due to decreased volume of body fluid [15].The burden of diarrhea diseases disproportionately affects young children in low and middle income countries [17, 18]. Among children, those exposed to poor environmental condition are at increased risk to develop severe diarrhea [4].

A systematic review conducted in 2003 confirmed a substantial decline in under-five mortality from diarrhea diseases [19]**.** An updated systematic review in 2013 by Walker colleagues similarly reported a substantial decline in under-five deaths from diarrhea between 2000 and 2010 [18]**.** The decline in under-five mortality from diarrhea diseases are believed to be as a result of the increased use of oral rehydration therapy, improved nutrition, increased breastfeeding, better supplemental feeding, female education and improvement in sanitation and hygiene [20]. Despite improving trends in under-five mortality rates from diarrhea diseases, morbidity rates attributable to diarrhea are high [19] .

In Nigeria, the prevalence of diarrhea is 18.8% and above the average of 16% [2]. The 2013 Nigeria Demographic and Health further reported an under-five mortality rate of 128 deaths per 1000 live births [21].

2.3 DIARRHEA PREVENTION AND MANAGEMENT

The WHO has identified recommendations for preventing childhood diarrhea. This include ensuring access to safe drinking water, use of improved sanitation, good personal and food hygiene, exclusive breastfeeding for the first six months of life, and rotavirus vaccination [1].

The treatment for diarrhea include the use of oral rehydration salts (ORS) which prevents and treats dehydration from acute diarrhea, zinc supplementation which decreases the severity and duration of diarrhea [1, 18, 22]. In addition, consulting with a health professional when there is blood in stool or if there are signs of dehydration [1].

2.4 MATERNAL MANAGEMENT OF DIARRHEA

While several studies have reported the effectiveness of oral rehydration solution and timely medical attention in the management of under-five diarrhea [10]. The extent to which these diarrheal management procedures are undertaken is greatly influenced by the child's family. As mentioned earlier, mothers play an important role in childhood disease prevention and management [10, 11, 23, 24]. Therefore, it is important to understand factors that influence maternal management of diarrhea in children [10].This review focused on maternal socio-demographic factor, socio-economic factors that have been found to influence the use of ORS and seeking medical care for under-five diarrhea episodes. The choice of ORS use and seeking care at health facility as the diarrhea management practice in focus was informed by the 2004 joint statement for diarrhea management by the WHO and UNICEF. ORS use and seeking immediate medical care were identified as effective and appropriate management practices for under-five diarrhea episodes [25].

Maternal management of diarrhea, specifically the use of oral rehydration solution (ORS) for under-five diarrhea management has been found to be influenced by various socioeconomic and demographic factors [10]. Maternal education, place of residence, and household income are instances of determinants that have been found to be associated with maternal use of ORS [9, 24, 26, 27]. Among all these factors, available evidence shows a strong correlation between maternal education and improved childhood diarrhea management [10, 23, 24, 28]**,** after controlling for other confounders. A study in Czech found that higher maternal education was significantly associated with maternal knowledge and use of ORS [23]. Similarly, Webb and colleagues [24] found that in rural Guatemala, greater maternal academic skills were associated with improved care for infant diarrhea. A systematic review on diarrhea in India also reported association between maternal education and management of diarrhea [29]**.**The study found that mothers with little or no education, living in rural areas, and belonging to households in the lower wealth quintiles were less likely to give their children ORS during diarrhea episodes [29]**.**

Place of residence have been reported to influence maternal use of ORS during under-five diarrhea episodes. A 1994 study in Philippines found that mothers who rise in rural areas were more likely to give their children ORS during diarrhea episodes that mother who reside in urban areas[30].

2.5 THEORETICAL FRAMEWORK

Researchers have proposed different theoretical frameworks to explain influences of maternal factors on child health outcomes, such as childhood undernutrition, childhood diarrhea, childhood mortality etc. [31]. This paper employs a combination of two theoretical frameworks: Mosley-Chen Conceptual Framework, and Andersen Behavioral Model to understand factors

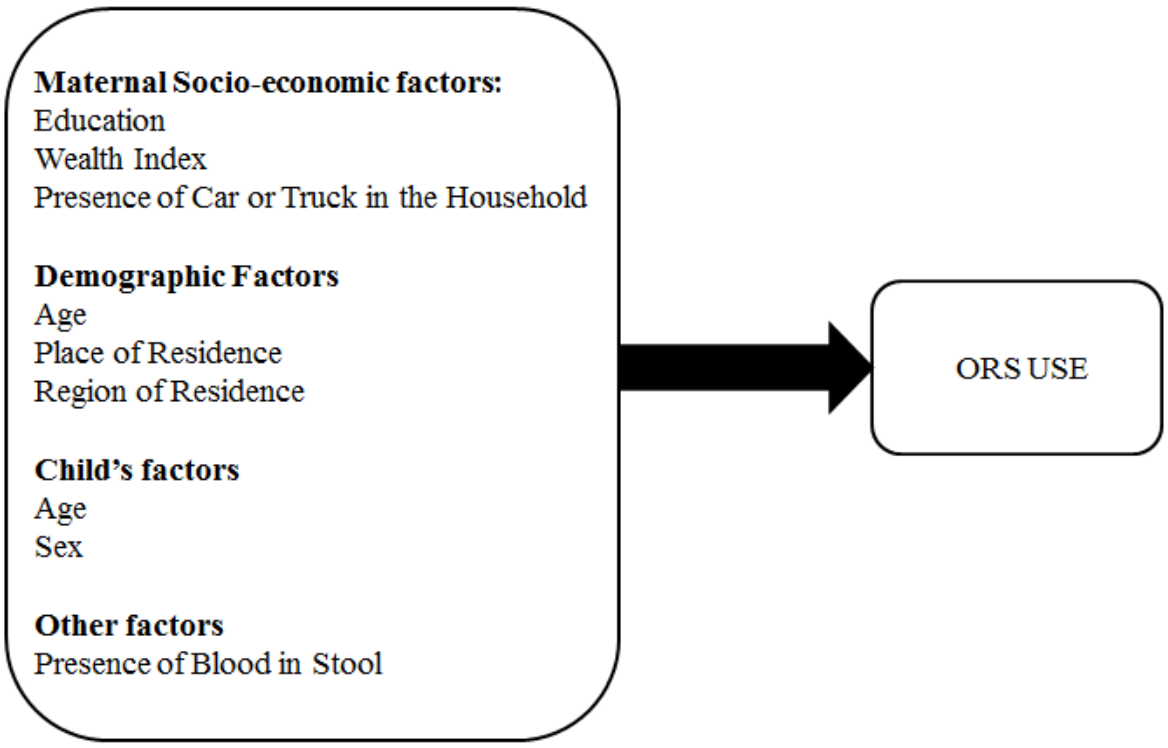
influencing maternal behaviors of giving ORS or taking a child to a medical facility during diarrhea episodes.

Mosley-Chen Conceptual Framework

Mosley-Chen conceptual framework developed by Mosley and Chen has been widely used to describe factors influencing child health outcomes (childhood mortality and survival) [32, 33]. This framework proposes that child health outcomes are influenced by underlying factors such as socio-economic and biological determinants which operate through proximate determinants [32]. The proximate determinants include maternal factors (such as age, parity), environmental contamination, nutrient deficiency, injury and personal illness control (such as personal preventive measures, medical treatment) [32, 33].

Guided by this framework and findings from empirical evidence, this study focuses on maternal factors (such as educational level, age, place of residence), child demographic factors (sex of child, age of child), and presence of blood in stool as determinants of maternal use of ORS for under-five diarrhea episodes. Figure 2 below adopted from the Mosley and Chen framework for child survival, proposes that factors such as mother's education, age, wealth index, place of residence, region of residence and the presence of blood in stool influences mothers choice to give ORS to their children as a measure to manage diarrhea episodes. These factors can work as independent factors or can interact with other factors to influence maternal under-five diarrhea management practice.

Figure 1: Conceptual framework for maternal factors and ORS use for under-five diarrhea episodes



Andersen's Behavioral Model

In order to understand mother's individual experiences seeking medical help for under-five children's diarrhea episodes, Andersen's Behavioral Model is used. Andersen's Behavioral model was originally developed in the late 1960s to help understand factors that influence individual's health care use[34, 35]. Overtime, the model has undergone revisions and updates to include vulnerable population [35, 36].

This framework suggests that individual's use of services is as a result of three determining factors: a) predisposing factors, b) enabling factors, and c) need factors [35-37].

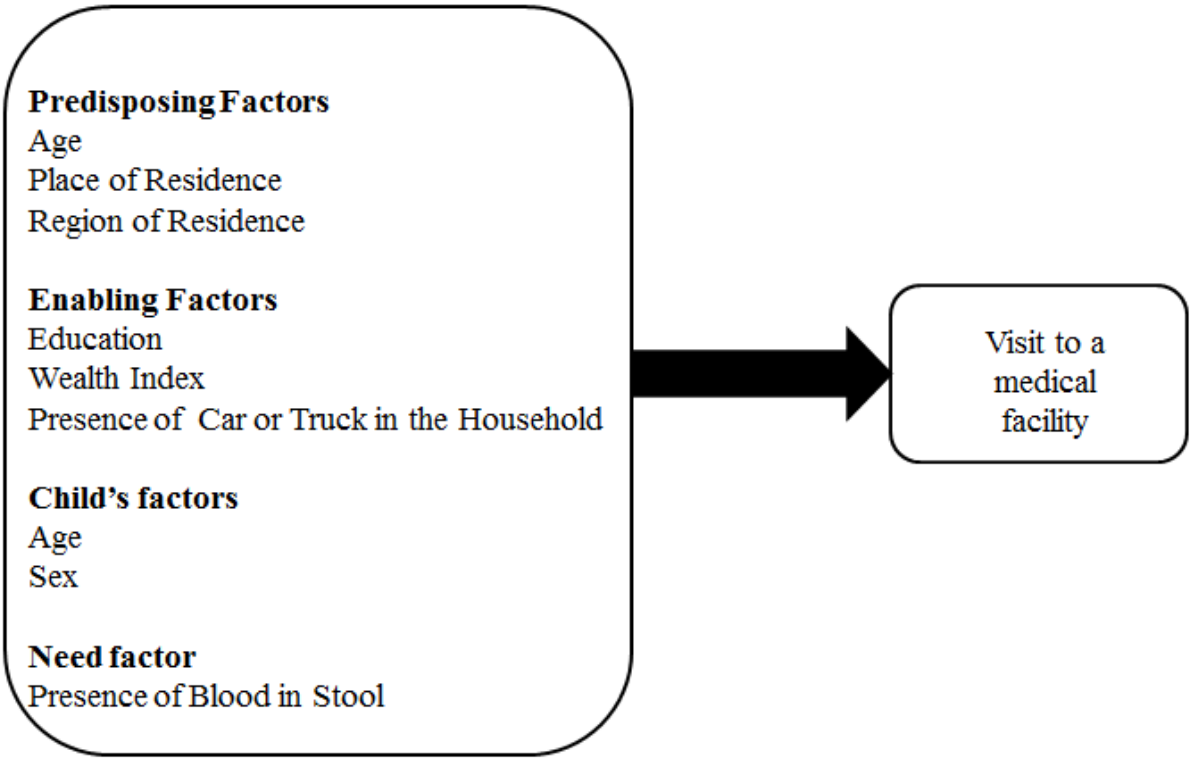
Predisposing factors involves an individual's predisposition to use health services; this include socio-demographic characteristics (e.g. age, sex, education, marital status, occupation, ethnicity) and health beliefs "Health beliefs are attitudes, values, and knowledge that people have about health and health services that might influence their subsequent perceptions of need and use of health services" [35] .

Enabling factors looks at individual and community characteristics that either encourage or discourage the use of health services [35]. Although some individuals might be predisposed to use health services, there are components that need to be available to encourage the use of health services[34].Enabling factors make health service resources available to individuals and be measured by considering source income, availability of health facilities and personnel, individual's region and place of residence[34].

The need factor includes a perceived and evaluated need component[35]. A perceived need is an individual's perception of needing medical care which could depend on evident symptoms or other health determining factors established by the individual. Evaluated need on the other hand involves a professionals assessment of an individual's health status and their need for medical care [35].

Guided by the Andersen Behavioral Model and variables obtained from previous studies a conceptual framework was developed to explore the influence of some maternal factors on the choice of taking a child under the age of five to a medical facility during diarrhea episodes (Figure 3).

Figure 2: Conceptual framework for maternal factors and visit to a medical facility for under-five diarrhea episodes



2.6 RESEARCH QUESTIONS

The purpose of this study is to contribute to the existing literature which examines relationship between maternal factors and management of under-five diarrhea.

Using the modified Mosley-Chen Childhood survival framework, the maternal diarrhea management practice of interest is using ORS for under-five diarrhea episodes. In addition, using the Behavioral Model of Health Service use, the maternal diarrhea management practice of interest is interest is mother's seeking medical attention during diarrhea episodes of their children under the age of five.

This study will examine the following questions and related hypotheses;

A) Is there a significant association between maternal education and ORS use for under-five diarrhea episodes?

   Hypothesis: There is a significant association between maternal education and ORS use for under-five diarrhea treatment. Mothers who have secondary education or higher will be significantly more likely to use ORS compared to mother who have no education.

B) Is there a significant association between maternal education and visiting a medical facility for under-five diarrhea episodes?

   Hypothesis: There is a significant association between maternal education and seeking medical attention for under-five diarrhea treatment. Mothers who have secondary education or higher will be significantly more likely to seek medical attention for under-five diarrhea episode compared to mothers who have no education.

C) Is there a significant association between wealth index and visiting a medical facility for under-five diarrhea episodes?

   Hypothesis: There is a significant association between wealth index and seeking medical attention for under-five diarrhea treatment. Mothers who are classified as richest will be significantly more likely to take their children to a medical facility compared to those classified as poorest.

D) Is there a significant association between finding blood in the stool and visiting a medical facility for under-five diarrhea episodes?

   Hypothesis: There is a significant association between finding blood in the stool and seeking medical attention for under-five diarrhea treatment. Mothers who find blood in

their child's stool will be significantly more likely to take their children to a medical facility compared to those who do not find blood in their child's stool.

CHAPTER 3
METHODS

3.1 DATA SOURCE AND STUDY DESIGN

Data from 2013 Nigerian Demographic Health Survey (NDHS) was utilized for this study. The NDHS samples are nationally representative and include the entire population of non-institutionalized residents [21]. The sampling design consisted of a stratified three-stage cluster design. Census Enumeration Areas which are 40, 680 household samples were included in the survey, including all six regions of the country and the Federal Capital Territory, both urban and rural areas. Three different questionnaires were utilized in the interview process: a household questionnaire, and separate men's and women's questionnaires. The questionnaires also asked questions about children under age 18. Men and women ages 15-49 in these household eligible to complete the surveys. A total of 38,948 women, 17,359 men, and 8,658 couples completed the survey. This study was restricted to the "Woman Questionnaire" that specifically included information about mothers' who had children under the age of five with diarrhea. The participants included in the study were mothers who had children under the age of five years who had diarrhea two weeks preceding the survey. The final sample for the study included 3,069 of children with diarrhea and their mothers. Off which n=2,908 (94.75%) provided their children with ORS and n=861 (28.06%) took their children to a medical facility. Figure-1 displays the flow chart for the eligible participants for the study.

3.2 DESCRIPTION OF STUDY SITE

Nigeria is located in West Africa with a population of over 140 million (NDHS, 2013). The country is made up of 36 states and a Federal Capital Territory, which is grouped into regions: North Central, North East, North West, South East, South South, and South West[21].

Each state is subdivided into local government areas (LGAs). There are 772 constitutionally recognized LGAs in the country [21]. These LGAs are further divided into localities. The study

3.3 STUDY VARIABLES

Outcome (dependent) variables

The main outcome variable in this study is mother's management of diarrhea among under-five children. The information was obtained from questions on if mothers with under-five children with diarrhea provided them with oral rehydration solution (ORS), and if they took their children to a medical facility during a diarrhea episode. Mother's provision of ORS to their children during diarrhea was recoded as binary variables (0=did not provide ORS to the child, 1 = provided ORS to child). Mothers who took their children to medical facility during diarrhea episodes were recoded as binary variables as well (0=did not take the child to a medical facility during diarrhea episode, 1= took the child to a medical facility during diarrhea).

Explanatory (independent) variables

The independent variables used in the study were selected based on empirical evidence from previous studies related to maternal management of under-five diarrhea and aforementioned conceptual frameworks.

Mother's age

Maternal age was measured by asking women to report their age in years. This was recoded into 3-year age groups (15-24, 25-34, 35-49)

Maternal education

Maternal education was assessed by asking women for their highest level of education attained. This was grouped as primary, secondary, higher, and no education.

The wealth-index (socio-economic) status

Wealth status was classified into five groups: poorest, poorer, middle, richer and richest

Region of Residence

Region of residence was reported based on the six geopolitical zones in Nigeria: North-central, North-east, North-west, South-east, South-south, and South-west

Place of Residence

Place of residence was classified as living in urban or rural areas

Presence of car or truck in the household

The presence of car or truck in the household was coded as yes or no

Index child's age

Child's age was recoded into three groups (0-24 months, 25-34 months, 35-59 months)

Index child's gender

The child's gender was grouped as male or female.

Presence of blood in the stool

The blood in the stool was coded as yes or no

3.4 DATA ANALYSES

STATA S.E. 14 (STATA Corp., Inc. College Station, TX) was used for all the statistical analyses. The data was analyzed in relation to two outcome (dependent) variables ORS use and medical facility visit. Explanatory (independent) variables included: mother's age, mother's education, wealth index, region of residence, place of residence, presence of car or truck in the household, index child's age, index child's gender, and the presence of blood in the stool.

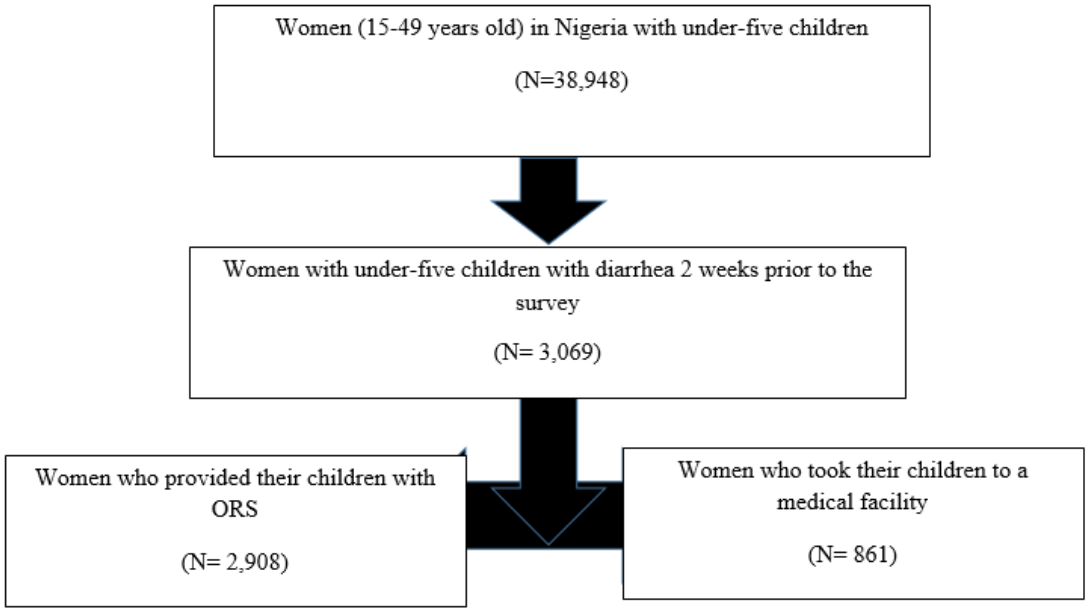
Descriptive statistical analyses of all independent variables and dependent variable were conducted. Bivariate analyses were conducted for associations between dependent variables and all independent variables. Bivariate associations were assessed using chi-square. Multiple

logistic regression analyses were performed to determine association between the independent variable (maternal education) and dependent variables (use of ORS) controlling for place of residence, region of residence) wealth status, presence of car or truck in the household, maternal age, index child's age, and index child's gender. Odds ratios were used to interpret the associations between the outcome variables and explanatory variables. These tests were based on a 5 percent significance level.

3.5 ETHICAL CONSIDERATION

The survey data used in this study was based on publicly available dataset. Formal approval to use the survey data was obtained from Demographic and Health Surveys (DHS) Program ICF International. All guidelines for handling the data including treating data as confidential, were respected.

Figure 3: Flowchart of under-five children with diarrhea in Nigeria from 2013 Nigeria Demographic and Health Survey



CHAPTER 4
RESULTS

4.1 SAMPLE CHARACTERISTICS

A total of 3,069 under-five children with diarrhea and their mothers were included in the study. Of the 3,069 children, 1539 (50.15%) were male and 1530 (49.85%) were female. The mean age for the children included in the study was 23.63months (SD=14.84). Most of the mothers in the study were between 25-34 years (48.0%). Majority of the mothers reside in the rural part of the country (70.48%, n=2163). Nearly half of the mothers resided in the north-eastern region of the country (42.72%); 27.04% in the north-west, 10.17% in the north-central, 7.89% in the south-east, 7.69% south-west, and 4.50% in the south-south. Majority of the mothers had no education (55.46%), 19.7% had primary education, 21.51% had secondary education, and 3.29% had higher education. Most of the households (28.58%) were in the poorest category of wealth status, 27.21% in the poorest category, 19.22% in the middle category, 14.76% in the richer category, and 10.23% in the richest category. 91.94% of the participants reported not having a car or truck in their household and about 83% of the children did not have blood in their stool during their diarrhea episode (Table 1).

4.2 HEALTHCARE-SEEKING PRACTICES OF MOTHERS FOR UNDER-FIVE DIARRHEA EPISODES

Out of the 3,069 mothers, 2908 (94.75%) (Figure 4) reported giving ORS and 861 (28.05%) (Figure 5) reported visiting a medical facility for childhood diarrhea under the age of five years, two weeks preceding the survey.

Table 1: Demographic characteristics of the study population (mothers and under-five children)

Total Number of Children with Diarrhea N=3,069	
	n (%)
Region of Residence	
North Central	312 (10.17)
North East	1311 (42.72)
North West	830 (27.04)
South East	242 (7.89)
South South	138 (4.50)
South West	236 (7.69)
Mother's Age	
15-24 years	877 (28.58)
25-34 years	1474 (48.03)
35-49 years	718 (23.40)
Place of Residence	
Urban	906 (29.52)
Rural	2163 (70.48)
Maternal Education	
Primary	606 (19.75)
Secondary	660 (21.51)
Higher	101 (3.29)
No Education	1702 (55.46)
Wealth Index	
Poorest	877(28.58)
Poorer	835 (27.21)
Middle	590(19.22)
Richer	453(14.76)
Richest	314 (10.23)
Owns Car/Truck	
Yes	245 (8.05)
No	2797(91.95)
Presence of Blood in Stool	
Yes	473 (17.15)
No	2285 (82.85)
Age of Index Child	
0-24 months	1745 (59.39)
24-34 months	475 (16.17)
35-59 months	718 (24.44)
Gender of Index Child	
Male	1539 (50.15)
Female	1530 (49.85)

Figure 4: Distribution of maternal us of ORS for under-five diarrhea episodes

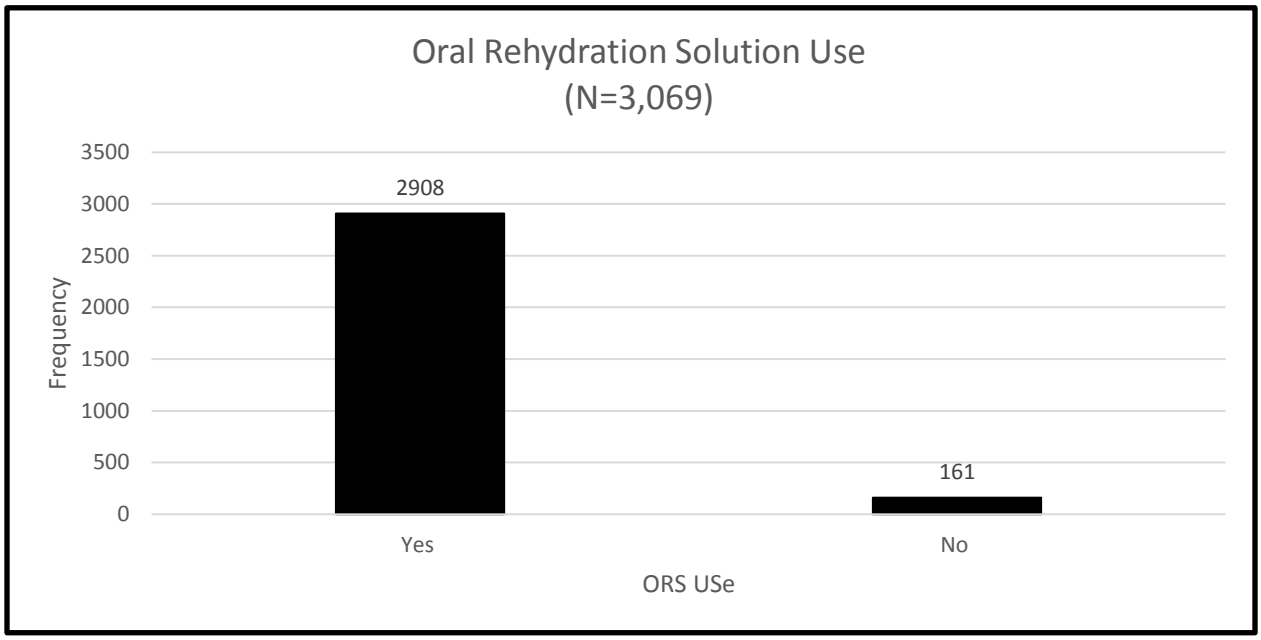


Figure 5: Distribution of maternal visit to medical facility for under-five diarrhea episode**s**

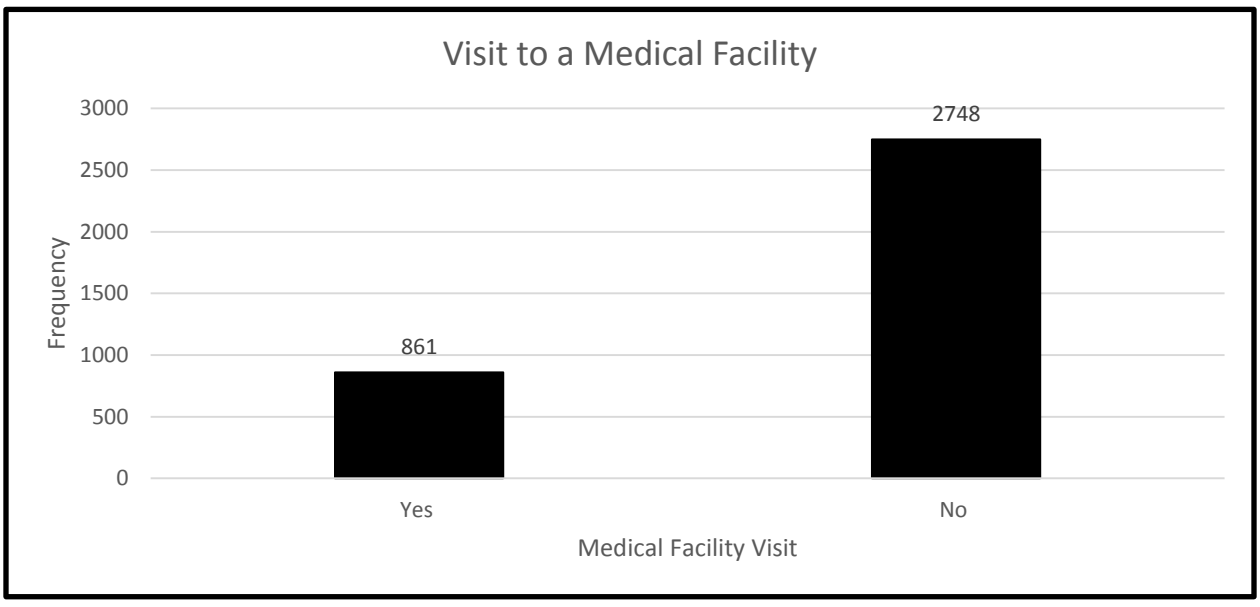


Table 2: Frequencies of ORS use and visit to a medical facility (MF) for under-five diarrhea episode by selected independent variables (N=3,069)

Total Number of Children with Diarrhea N=3,069					
		Diarrhea Management Behavior			
		Provided ORS		**Took the child a Medical Facility**	
	(N=3,069)	N=2,908 (94.75%)		N=861	
	All(%)	**n(%)**	**p-value**	**n(%)**	**p-value**
Region of Residence			**<0.001**		**<0.001**
North Central	312 (10.17)	127 (40.71)		123 (39.42)	
North East	1311 (42.72)	343 (26.16)		311 (23.72)	
North West	830 (27.04)	262 (31.57)		241 (29.04)	
South East	242 (7.89)	95 (39.26)		70 (28.93)	
South South	138 (4.50)	39 (28.26)		35 (25.36)	
South West	236 (7.69)	102 (43.22)		81 (34.32)	
Place of Residence			**<0.001**		**<0.001**
Urban	906 (19.52)	388 (42.83)		324 (35.76)	
Rural	2163 (70.48)	580 (26.81)		537 (24.83)	
Maternal Education			**<0.001**		**<0.001**
Primary	606 (19.75)	190 (31.35)		186 (30.69)	
Secondary	660 (21.51)	266 (40.30)		216 (32.73)	
Higher	101 (3.29)	66 (65.35)		62 (61.39)	
No Education	1702 (55.46)	446 (26.20)		397 (23.33)	

Table 2 (Cont.)

Wealth Index			**<0.001**		**<0.001**
Poorest	877 (28.58)	167 (19.04)		156 (17.79)	
Poorer	835 (27.21)	240 (28.74)		221 (26.47)	
Middle	590 (19.22)	220 (37.29)		190 (32.20)	
Richer	453 (14.76)	175 (38.63)		163 (35.98)	
Richest	314 (10.23)	166 (52.87)		131 (41.72)	
Owns Car/Truck			**<0.001**		**0.001**
Yes	245 (8.06)	111 (45.31)		88 (35.92)	
No	2795 (91.94)	850 (30.41)		766 (27.40)	
Maternal Age			**0.001**		**0.392**
15-24 years	877 (28.58)	250 (28.51)		232 (26.45)	
25-34 years	1474 (48.03)	514 (34.87)		426 (28.90)	
35-49 years	718 (23.40)	204 (28.41)		203 (28.27)	
Index Child's Age			**0.037**		**0.006**
0-24 months	1745(59.39)	606 (34.73)		549 (31.46)	
24-34 months	475(16.17)	133 (28.00)		19 (4.00)	
35-59 months	718(24.44)	219 (30.50)		186 (25.91)	
Index Child's Gender			**0.009**		**0.909**
Male	1539 (50.15)	454 (29.50)		431 (28.01)	
Female	1530 (49.85)	514 (33.60)		430 (28.10)	
Presence of Blood in Stool			**0.430**		**<0.001**
Yes	473 (17.15)	165 (34.88)		174 (36.79)	
No	2285 (82.85)	758 (33.17)		643 (28.14)	

% Percentages represent the proportion of children within each group who received either of the diarrhea management method of interest. For example, 78.8% of children who reside in the North-Central region of the were provided with ORS, and the remaining 21.2% were not.

ORS = Oral Rehydration Solution

4.3 BIVARIATE ANALYSES: CHI-SQUARE

ORS Use

The results of the bivariate analyses showed most of the independent variables were statistically associated with that maternal provision of ORS during under-five diarrhea episode ($p<0.05$): region of residence ($p<0.001$), place of residence ($p<0.001$), maternal education ($p<0.001$) , wealth status ($p<0.001$), presence of a car or truck in the household ($p<0.001$), maternal age ($p=0.001$), maternal age ($p=0.037$), and child's gender ($p=0.009$) (table 1). However, there was no statistically significant association between maternal provision of ORS during under-five diarrhea episode and the presence of blood in the child's stool (Table 3)

Visit to a medical facility

Further, the results of the bivariate analyses showed that there were statistically significant associations ($p<0.05$) between mother's taking their under-five children to a medical facility during diarrhea episode and region of residence, place of residence, maternal education, wealth index, presence of a car or truck in the household, presence of blood in the child's stool, and child's age. No statistically significant association was found between mother's taking their under-five children to a medical facility during diarrhea episode and maternal age. Similarly, child's gender was not found to be statistically associated with mother's taking their children to medical facility during diarrhea episodes (Table 2).

4.4 MULTIVARIATE ANALYSES: LOGISTIC REGRESSION

Tables 3 and 4 contains results of the full and reduced (only including variables identified as statistically associated with the dependent variables from the bivariate analysis) models respectively. In the final model, which is the reduced model, several factors were associated with the dependent variables.

The results of the full model shows that mothers who reside in the South-south region are 49 times less likely to use ORS (OR=0.49; 95% CI:0.30-0.78; p<0.01) compared to mothers who reside in the North-central region. The other regions (North-east, North-west, South-east, and South-west) were not found to be statistically different from the north central region at an alpha of 0.05. Mothers who lived in rural areas were 0.77 less likely to provide their children with ORS during diarrhea episodes (OR=0.77; 95% CI:0.61-0.97; p<0.05). Maternal wealth index had a significant association with mother's provision of ORS to their children during diarrhea episodes. Mothers classified as poorer in the wealth index category were found to be 1.66 times more likely to give their children ORS compared to mother classified as poorest in the wealth index category (OR=1.66; 95% CI 1.30-2.12; p<0.001).Those classified as richest were 3.16 times more likely to give their children ORS than those classified as poorest (OR=3.16; 95% CI: 2.09-4.78; p<0.001). Furthermore, only mothers with higher education were different from mothers with no education. Mothers with primary education and secondary education were not found to be statistically different from mothers with no education. Mothers with higher education were found to be 2.56 times more likely to give their children ORS than those with no education (OR=2.56, 95% CI: 1.2-4.69; p<0.001). The age of the mothers had significant association with maternal use of ORS. Mothers aged between 25 and 34 years were 1.29 times more likely to give their children ORS than those aged between 15 and 24 years. Mothers who were between 35 and 49 years were not found to be statistically different from mother aged 15-24 years in terms of providing ORS to their children. Additionally, having a car or a truck versus not having a car or truck was found to be statistically associated with mother's use of ORS (OR=0.99, 95% CI: 1.06-1.56). Mothers with children ages 25-34 months were 0.77% times

more likely to give the child ORS than those with children ages 0-24 months (OR=0.77, 95% CI: 0.61-0.97).

In the reduced model after controlling for the presence of blood in the stool as it was not statistically significant in the bivariate analysis, the north-east region emerged to be statistically different from the north central region. This is in addition to the south-south region which was statistically different from the north-central region in the full model. Mothers who reside in rural areas were still found to be less likely to use ORS compared to those who reside in urban areas (OR=0.79; 95% CI: 0.63-0.99; $p<0.05$). Mothers with education levels higher than secondary remained more likely to provide ORS than those with no education (OR=2.81; 95% CI: 1.68-4.69; $p<0.005$). Similar to the full model, mothers with no education were not statistically different from mothers with primary education or secondary education. In regards to owning a car or truck, in the reduced model mothers with cars or truck in the household were significantly less at odd of giving ORS compared to mothers without cars or trucks (OR= 0.99; 95% CI:1.06-1.56; $p<0.05$).

In the full model, several factors were significantly associated with mothers visit to a medical facility during under-five child diarrhea episode: residing in the north-east (OR=0.70, 95% CI: 0.52-0.94; $p<0.05$) or south-east (OR=0.50, 95% CI: 0.33-0.74; $p<0.001$) or south-south (OR=0.43, 95% CI:0.26-0.69; $p<0.001$) or south-west (OR=0.61, 95% CI:0.41-0.91; $p<0.05$) versus residing in the north-central region. Although not statistically significant, mothers who reside in rural areas are less likely to take their child under the age of five to a medical facility during diarrhea episodes. Mothers who have higher education were 3.43 times more likely to take their children to a medical facility during diarrhea episode than those with no education (OR=3.43, 95% CI 2.06-5.71; $p<0.001$). Likewise, mothers with primary education were 1.30

times more likely to take their children to a medical facility compared to those with no education (OR=1.30; 95% CI: 1.03-2.04; $p<0.05$). However, mothers with secondary education were found not to be statistically different from mothers with no education. Mothers classified as richest, richer, middle, and poorer were more likely to take their children to a medical facility compared to those classified as poorest. Mothers with children with no blood in their stool were less likely to take their children to a medical facility (OR=0.55; 95% CI: 0.44-0.69; $p<0.001$).

In the reduced model after controlling for child's gender which was found not to be statistically significant in the bivariate analysis, only region of residence, maternal education, and wealth index were found to be statistically associated with maternal visit to a medical facility. Mothers residing in North-east, South-East, South-south, and South-west regions were less at odds of going a medical facility for under-five diarrhea episodes, at odds ratio of (0.70, 0.49, 0.43, and 0.61) respectively. Whether mother resided in a rural or urban area was not statistically associated with maternal visit to a medical facility for their child's diarrhea episodes. Likewise, a child having blood in their still was not statistically associated with maternal visit to a medical facility.

Table 3: Logistic regression models with odds ratios, p-value and confidence intervals for maternal ORS use during under-five diarrhea episode

Total Number of Children with Diarrhea N=3,069

	Diarrhea Management Behavior : Provided ORS	
	Full Model OR (95% CI)	Reduced Model OR (95% CI)
Region of Residence		
North Central	Reference	Reference
North East	0.76 (0.57,1.02)	0.71(0.52-0.94)*
North West	0.998(0.73,1.36)	0.93(0.69-1.26)
South East	0.73(0.50,1.08)	0.71(0.49-1.04)
South South	0.49(0.30,0.78)**	0.50(0.31-0.79)**
South West	0.78(0.53,1.16)	0.73(0.50-1.08)
Place of Residence		
Urban	Reference	Reference
Rural	0.77(0.61,0.97)*	0.79(0.63-0.99)*
Maternal Education		
Primary	0.9998 (0.789,1.27)	1.00(0.79-1.25)
Secondary	1.22 (0.933,1.59)	1.20(0.92-1.55)
Higher	2.56 (1.52,4.32)***	2.81(1.68-4.69)***
No Education	Reference	Reference
Wealth Index		
Poorest	Reference	Reference
Poorer	1.66 (1.30,2.12)***	1.67(1.32-2.11)***
Middle	2.31 (1.74,3.05)***	2.26(1.73-2.97)***
Richer	2.17 (1.54,3.04)***	2.08(1.50-2.90)***
Richest	3.16 (2.09,4.78)***	3.02(2.01-4.52)***
Owns Car/Truck		
Yes	1.02 (1.06,1.58)*	0.99(1.06-1.56)*
No	Reference	Reference

Table 3 (Cont.)

Maternal Age		
15-24 years	Reference	Reference
25-34 years	1.29 (1.06,1.58)*	1.29(1.06-1.56)*
35-49 years	1.01(0.80,1.29)	1.03(0.82-1.31)
Index Child's Age		
0-24 months	Reference	Reference
25-34 months	0.78(0.62,0.99)*	0.77(0.61-0.97)*
35-59 months	0.93 (0.76,1.14)	0.93(0.76-1.13)
Index Child's Gender		
Male	Reference	Reference
Female	1.19 (1.01,1.41)*	1.22(1.04-1.43)*
Presence of Blood in Stool		**NS**
Yes	Reference	
No	0.72 (0.58,0.90)**	

*p<0.05, ** p<0.01, ***p<0.001

Table 4: Logistic regression models with odds ratios, p-value and confidence intervals for visit to a medical during under-five diarrhea episode

Total Number of Children with Diarrhea N=3,069

	Diarrhea Management Behavior	
	Full Model OR (95% CI)	Reduced Model OR (95% CI)
Region of Residence		
North Central	Reference	Reference
North East	0.70(0.52-0.94)*	0.70(0.52-0.94)*
North West	0.97(0.71-1.32)	0.97(0.71-1.32)
South East	0.50(0.33-0.74) ***	0.49(0.33-0.74)***
South South	0.43(0.26-0.69) ***	0.43(0.26-0.69)***
South West	0.61(0.41-0.91)*	0.61(0.41-0.91)*
Place of Residence		
Urban	Reference	Reference
Rural	0.80(0.63-1.02)	0.80(0.63-1.02)
Maternal Education		
Primary	1.30(1.03-2.04)*	1.02(1.03-1.65)*
Secondary	1.30(0.99-1.71)	1.28(0.98-1.67)
Higher	3.43(2.06-5.71)***	3.68(2.23-6.05)***
No Education	Reference	Reference
Wealth Index		
Poorest	Reference	Reference
Poorer	1.59(1.24-2.04)***	1.57(1.24-2.00)***
Middle	1.89(1.42-2.53)***	1.96(1.49-2.59)***
Richer	2.11(1.49-3.00)***	2.13(1.53-2.98)***
Richest	2.26(1.47-3.47)***	2.26(1.49-3.43)***

Table 4 (Cont.)

Owns Car/Truck		
Yes	1.00(0.89-1.12)	0.97(0.87-1.09)
No	Reference	Reference
Maternal Age		
15-24 years	Reference	Reference
25-34 years	1.17(0.95-1.43)	1.08(0.89-1.32)
35-49 years	1.16(0.91-1.47)	1.16(0.91-1.47)
Index Child's Age		
0-24 months	Reference	Reference
24-34 months	0.79(0.62-1.00)	0.79(0.62-1.00)
35-59 months	0.86(0.69-1.06)	0.86(0.69-1.06)
Index Child's Gender		**NS**
Male	Reference	
Female	0.96(0.81-1.14)	
Presence of Blood in Stool		
Yes	Reference	Reference
No	0.55(0.44-0.69)***	0.55(0.44-0.69)

*p<0.05, ** p<0.01, ***p<0.001

CHAPTER 5
DISCUSSION

The primary goal of this analysis was to determine maternal characteristics influencing providing ORS and visiting a medical facility for under-five diarrhea episodes. Providing children with ORS during diarrhea episode has been considered to be important factors in decreasing under-five deaths due to diarrhea. Despite the confirmed importance of oral rehydration solution in preventing dehydration due to diarrhea, previous studies have reported low usage in Nigeria [9].On the contrary, findings from this study showed that majority of the mothers (94.75%) used ORS with their diarrheal children. However, hospital visits for under-five diarrhea episodes were low (28.05%). Nevertheless, mothers play an important role in the management of under-five diarrhea therefore it is important to explore factors that influence these practices.

While discussing overall under-five diarrhea management, maternal education is an important determinant factor in providing a child with ORS. Therefore, it is hypothesized that educated women are more likely to provide their children with ORS during diarrhea episodes compared to women with no education. Accordingly, the one of the objectives of this study was to assess the association between maternal education and use of ORS for under-five diarrhea. Likewise, the association between maternal education and visit to a medical facility was assessed.

The study represents the application of the Mosley and Chen framework in exploring maternal factors that influence maternal use of ORS for under-five diarrhea episodes. Three other factors (region of residence, place of residence, wealth index) in addition to maternal education emerged as having significant influence on maternal management practices. In a logistic

regression model with the independent variable maternal education and controlling for other known factors associated with maternal use of ORS, mother's having education higher than secondary school compared no education was significantly associated with the use of ORS. Similarly, residing in a rural versus urban setting, wealth status, maternal age bracket (15-24 years), child's age interval (25-34 months) and child's gender emerged as being statistically associated with maternal ORS use.

Increased maternal education appeared to be an important factor for mothers use of ORS for under-five diarrhea, mothers who have education higher than secondary level were more likely to give their under-five children ORS during diarrhea episodes. This finding is consistent with the results of Rasania and colleagues [38]who found that higher maternal education or literacy affects mother's understanding and preparation of ORS, thus the increased use of ORS for under-five diarrhea. This is contrary to findings of Datta and colleagues [26]who explored the impact of maternal education and use of ORS in rural India **.**They found that mother's education status did not have any significant association with maternal use of ORS for under-five diarrhea. This result was attributed to the homogeneity of mother's schooling status in the area; only very few mothers were educated to more than 10^{th} grade[26] .

We also found that mother's wealth status was associated with maternal use of ORS for under-five diarrhea. Mothers with wealth status categorized as poorest were found to be less likely to provide their under-five children with ORS during diarrhea episodes compared to all other wealth status categories. A few studies have displayed similar patterns, finding that lower income mothers were less likely to provide their under-five children with ORS during diarrhea episodes [39, 40].

Concurrent with previous study [41]**,** findings from this study support the association between place of residence and maternal use of ORS for under-five diarrhea management. However, a study in Pakistan found that mother's place of residence was not statistically associated with maternal use of ORS for under-five diarrhea management[27].

Likewise guided by the Andersen Behavioral Model, the study yielded significant association between maternal education and visit to a medical facility. Mothers with education levels higher than secondary school and those with primary education were more likely to take their children to a medical facility during diarrhea episodes than those with no education. Surprisingly, mothers with secondary education were not statistically different from mothers who had no education. Higher education can be considered as an enabling factor to mother's seeking medical assistance for under-five diarrheal episodes.

The study hypothesis stated that mothers classified as richest in the wealth index category will be significantly more likely to take their children to a medical facility compared to those classified as poorest. The study results supported the hypothesis, showing that mothers were classified as richest in the wealth index were 2.3 times more likely to take their children to a medical facility compared to those classified as poorest.

Another hypothesis guided by the need factor of the Andersen Behavioral model was that mothers who find blood in their child's stool will be significantly more likely to take their children to a medical facility compared to those who do not find blood in their child's stool. However, the results from the reduced logistic model found no statistically association between the presence of blood in a child's stool and mother's visit to a medical facility for under-five diarrheal episodes.

5.1 STUDY LIMITATIONS

This study has some limitations worth mentioning. First, the data is from a cross-sectional study, therefore it is impossible to assume causality between the explanatory variables and outcome variables [42]. Also, the self-reported nature of the data poses the problem of recall bias, particularly about mothers remembering if their children had diarrhea may have affected our secondary analysis [43, 44]. In addition, given that the data used was obtained from self-reported information from the mothers it was not possible to determine the type of diarrhea (whether it was acute, persistent or bloody diarrhea) that was reported [42]. Therefore this study did not specify if it was acute, persistent or bloody diarrhea that was considered. Another limitation is that the findings for this study are limited to Nigeria; therefore the findings cannot be generalized to other countries. Nevertheless, this study utilized the most recent NDHS data, which is a nationally representative household hence the findings can be generalized to the country level to an extent.

5. 2 IMPLICATIONS OF FINDINGS

Overall, the results from this study suggest the importance of maternal education in under-five diarrhea management, specifically the use of ORS and visit to a medical facility. Showing that maternal factors such as education influences under-five diarrhea managements suggests further avenues for research to understand the extent to which other maternal characteristics influences under-five diarrhea management. Thus, there is a need for further research, that examines how combined maternal individual and community level factors influences mother's management of diarrhea in under-five children. Further, we will recommend further study to identify maternal management practices for the different types of diarrhea.

CHAPTER 6
CONCLUSION

The Nigerian Demographic and Health Survey 2013 was used to determine maternal factors that influence care-seeking practices for under-five diarrhea episodes. Findings from the study show strong correlation between maternal education and use of ORS and visit to a medical facility as management practices for under-five diarrhea episodes. The results suggest that the level of education attained by the mothers is influential in determining diarrhea management practices for under-five diarrhea episodes. These findings are consistent with studies in other developing countries [9, 19]. Although this is a cross-sectional study and does not indicate causation, there is strong evidence from previous studies that show that such results have implications for child health policy makers. In relation to this, child health policy makers in Nigeria can also consider the influence of maternal education on the management of under-five diarrhea while creating programs and policies that are intended to improve child health.

In addition, the study highlighted influence of community level factors such as place of residence and region of residence on maternal management practices for under-five diarrhea episodes. This suggest community level factors in addition to maternal individual level factors may have important role to play in mothers practices in managing under-five diarrhea episodes. Although majority of the mothers provided their under-five children with ORS during diarrhea episodes, usage was significantly lower in rural areas. In addition, there were variations in maternal ORS usage across the six regions. Also, despite overall low visit to health facilities for under-five diarrhea episodes, mothers in rural areas were less like to take their children to a health facility. In light of these findings, policy makers need to prioritize the needs of

communities and form or modify policies that address the unique needs of each region or place of residence. This would be beneficial in addressing health inequalities in Nigeria.

Further studies on maternal factors influencing under-five diarrhea episodes in Nigeria will have to consider other maternal factors and community level factors not considered in this study. The variations in maternal management of childhood diarrhea across the different regions in Nigeria calls for study to determine other underlying factors that may influence such outcomes.

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