Household Choice of Diarrhea Treatments for Children under the Age of Five in Kenya

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DECLARATION

This research project is my original work and has not been presented for academic award in any other university.

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DEDICATION

This research project is dedicated to my wonderful parents, Mr. Benedict Muriithi and Mrs. Elizabeth Muriithi for their Godly parenting, love, care and support throughout my years of schooling. This product is just but a small proof that every prayer whispered and every wish made was not futile.

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Foremost thanks go to my God Almighty, for always guiding me, providing for me and working miracles in my life. I cannot thank You enough.

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LIST OF ABBREVIATIONS AND ACRONYMS

DCAH	Division of Child and Adolescent Health
HBM	Health Belief Model
HIV/AIDS	Human immunodeficiency Virus/Acquired Immunodeficiency Syndrome
IMCI	Integrated Management of Childhood Illness
KDHS	Kenya Demographic and Health Survey
MDG	Millennium Development Goals
MoPHS	Ministry of Public Health and Sanitation
ORT	Oral Rehydration Therapy
ORS	Oral Rehydration Salts
RHF	Recommended Home Fluids
U5 mortality	Under-Five mortality
UNDP	United Nations Development Programme
UNICEF	United Nations Children's Fund
WHO	World Health Organization

ABSTRACT

Childhood diarrhea is one of the leading causes of under-5 deaths in developing countries, including Kenya. Although it is one of the most easily prevented and managed childhood illnesses, it is the third leading cause of under-5 mortality and kills about 86 children in Kenya every day. The World Health Organization recommends the use of oral rehydration therapy (ORT) to manage diarrhea once it occurs as well as the use of zinc supplements to reduce the severity and future recurrence of the illness. This study investigated the factors that influence the household choice of treatments for children suffering from diarrhea across the country using a multinomial logit approach. A sample of 771 under-5 children was drawn from the 2008/2009 Kenya Demographic and Health Survey. It was found that 29.86 percent of the children were not administered with any sort of treatment for their diarrhea. Besides ORT and zinc, other treatments such as antibiotic drugs, antimotility drugs, and herbal medicines were used to manage childhood diarrhea. It was surprising to note that only 4 of the affected children were given zinc supplements. The study also found that prior knowledge/experience of oral rehydration salts, mother's education level, and place of residence were key determining factors of the use of recommended treatments to manage diarrhea. Factors such as household wealth, mother's age at birth and number of births in a span of five years were equally important for other treatments. Given the inadequate and low usage of ORT and zinc respectively, the study recommends strengthening awareness on childhood diarrhea and the recommended treatments that can be used to manage it as well as increasing the availability and accessibility of zinc supplements.

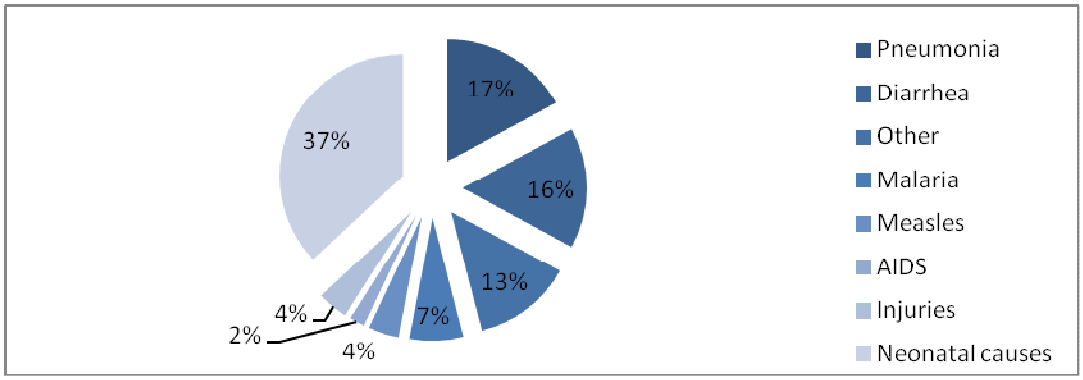
1.0. INTRODUCTION

Children represent the future labor force and it is important for governments to invest in this future pool of human resources. One way of achieving this is to promote the health of infants and children so as to reduce the number of deaths and disability caused by childhood diseases and injuries. Indeed, the importance of child health is well articulated in various programs and initiatives developed by the international community. For instance, the Millennium Development Goal 4 (MDG 4) aims at reducing child mortality by the year 2015. One of the targets of MDG 4 is "to reduce by two-thirds between 1990 and 2015, the under-five mortality rate," (United Nations Development Program, 2010: 28). With only 3 years shy of 2015, the MDG Report of 2010 shows that little progress has been made towards achieving MDG 4 in developing countries. Although Kenya has made significant progress in reducing under-five mortality, the target is yet to be achieved. This study focuses on childhood diarrheal disease, which is one of the leading causes of death among children under the age of five in Kenya.

1.1. The Burden of Childhood Diarrhea across the Globe

Globally, diarrhea is the second leading cause of mortality and morbidity among children under the age of five years. It is second to pneumonia, which together with diarrhea account for almost 40 percent of all child mortality across the globe every year (United Nations Children's Fund (UNICEF)/World Health Organization (WHO), 2009). Diarrhea is said to kill more children than a combination of malaria, AIDS and measles (see figure 1.1). On average, children under the age of 3 years in developing countries experience about three episodes of diarrhea every year.

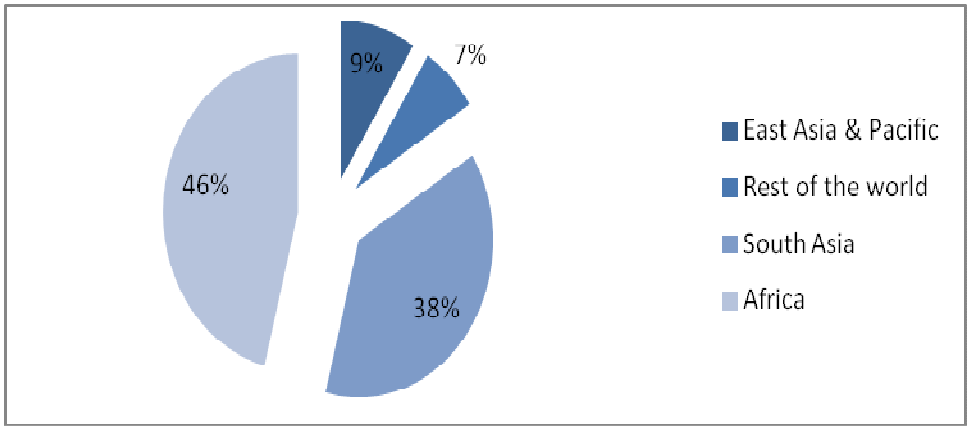
Figure 1.1: Proportional distribution of cause-specific under-5 deaths, 2004



Source: UNICEF/WHO, 2009.

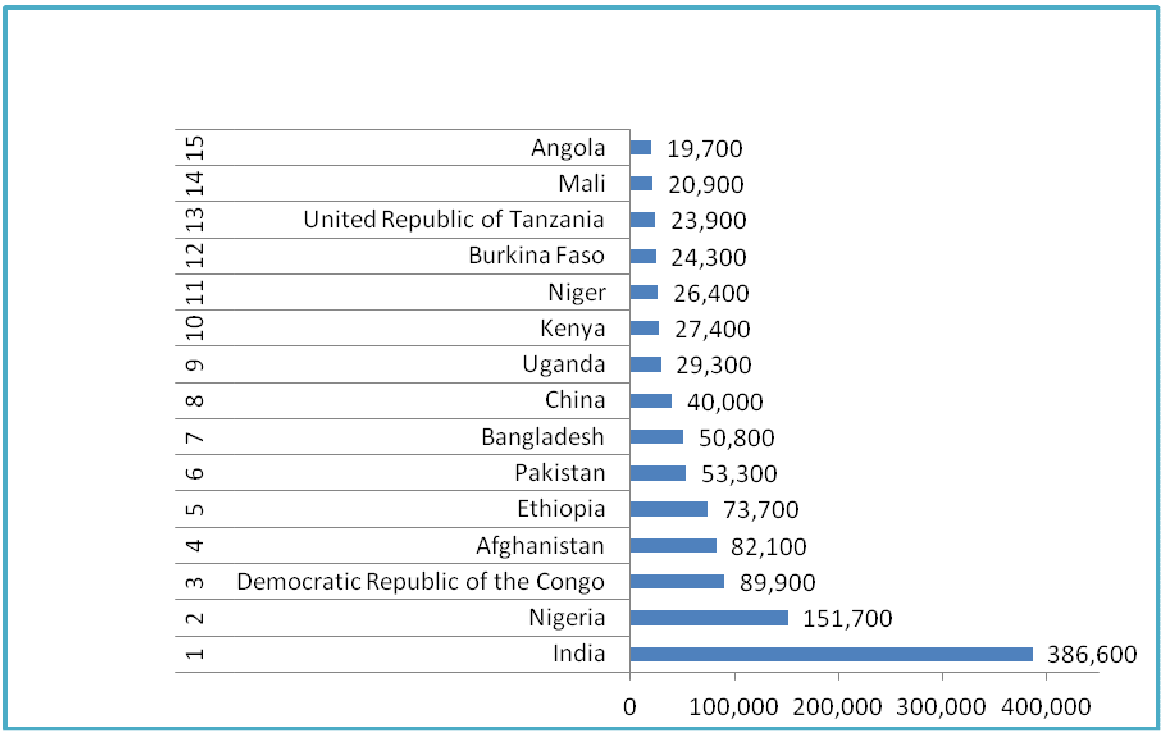
In developed countries, diarrhea is viewed as "a little more than an inconvenience" (UNICEF/WHO, 2009). In developing countries, however, diarrhea causes the loss of lives of approximately 1.5 million children under the age of five every year (UNICEF/WHO, 2009). Reports from the World Health Organization show that the burden of childhood diarrhea varies from one developing region to another, with the greatest burden experienced in Africa and South Asia. In Africa, according to the MDG Report of 2010, diarrhea is actually the leading cause of under-five deaths at 19%, followed by pneumonia (17%). Africa and South Asia account for more than 80 percent of all child deaths resulting from diarrhea (see figure 1.2). In addition, 75 percent of these deaths occur in only 15 countries (see figure 1.3). Kenya is ranked number 10 in the list of these 15 countries.

Figure 1.2: Proportional distribution of under-5 deaths due to diarrheal diseases, by region, 2004



Source: UNICEF/WHO, 2009.

Figure 1.3: Total number of U5 deaths due to diarrhea in top 15 countries



Source: UNICEF/WHO, 2009.

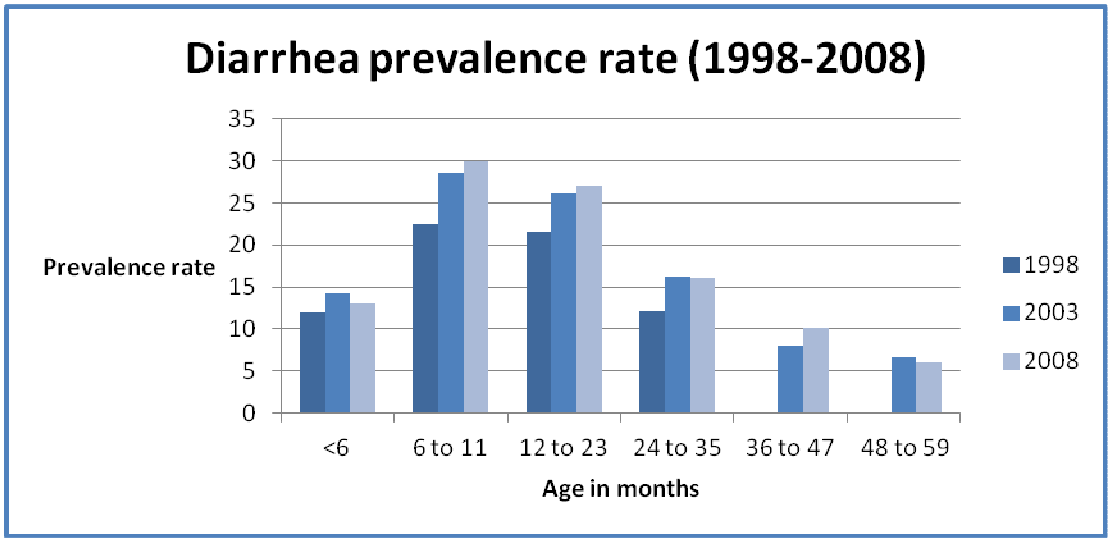
In the 1970s and 1980s, vigorous efforts by the international community led to a significant reduction in the number of child deaths caused by diarrhea. This was achieved mainly through efforts and programs created to scale up the use of oral rehydration therapy as well as education programs for caregivers on the appropriate use of the therapy. Unfortunately, the emergence of global health challenges such as HIV/AIDS shifted the attention from diarrhea and this led to a reversal of the progress made towards eradication of diarrhea. Currently, only 39 percent of children suffering from diarrhea in low income countries are administered with the recommended therapy. As a result, little progress has been made towards minimizing the impact of childhood diarrhea since 2000 (UNICEF/WHO, 2009).

1.2. The Burden of Childhood Diarrhea in Kenya

In Kenya, like in other developing countries, diarrhea is a major cause of child mortality and morbidity and comes third after neonatal causes and pneumonia, respectively. According to the Minister for Public Health and Sanitation, Dr. Beth Mugo, diarrhea kills about 86 children in

Kenya every day. Every Kenyan child under the age of five experiences an average of three bouts of diarrhea every year, according to the 2008 Kenya Demographic and Health Survey (KDHS 2008). Figure 1.4 shows the prevalence of childhood diarrhea in the country between 1998 and 2008.

Figure 1.4: Prevalence of childhood diarrhea in Kenya, 1998 – 2008



Source: Kenya Demographic and Health Surveys, 1998 – 2008

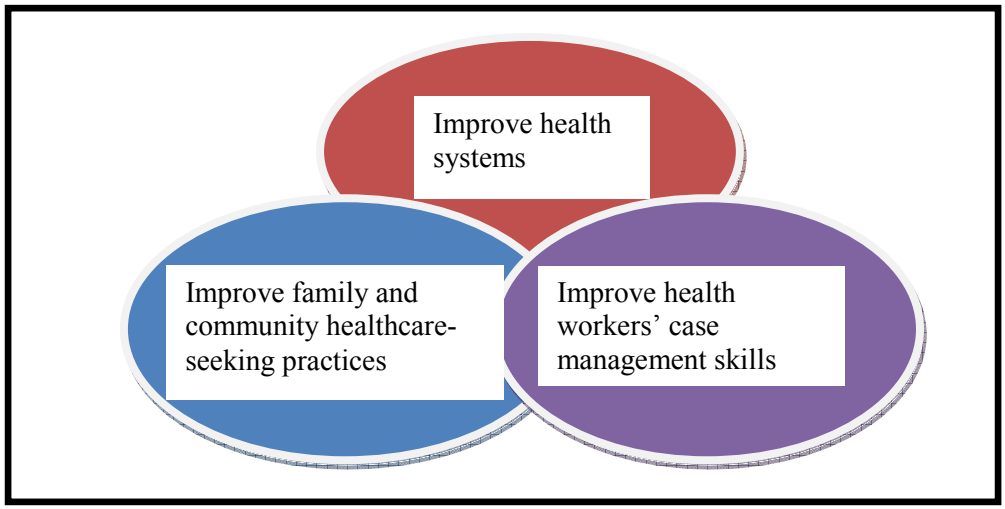
Figure 1.4 shows that the prevalence of diarrhea is highest in children aged between 6 and 11 months, followed closely by children between the age of 12 and 23 months. The prevalence rate then falls as children reach the age of two years. The figure also shows that the prevalence rate of childhood diarrhea has been rising steadily since 1998 for most of the age groups. This may indicate a number of possibilities such as the failure of the Kenyan Government to put up aggressive measures to curb the illness or under-utilization of treatment options by mothers and other caregivers of children. The figure provides proof of the reversal of progress that had been made towards the eradication of childhood diarrhea by the international community.

Needless to say, Kenya has a new policy on the management of childhood diarrheal diseases. The policy is well articulated in a document dubbed "Policy Guidelines on Control and Management of Diarrheal Diseases in Children Below Five Years" developed by the Ministry of Public Health and Sanitation (MoPHS) in 2010. The new policy guidelines support the country's

Child Survival and Development strategy and are founded on the successes and failures of the Policy Statement on Control of Diarrheal Diseases, which was established in 1993 and whose targets were to be achieved by the year 1997. The motivation behind the development of the new policy guidelines was the realization that mortality and morbidity rates from diarrheal diseases were on the increase. The policy guidelines take into account the new recommendations by the WHO for managing diarrhea, specifically, the use of zinc supplements and the new reduced (low) osmolarity ORS solutions (DCAH, MoPHS, 2010).

In addition, Kenya, in partnership with WHO and UNICEF, adopted the Integrated Management of Childhood Illness (IMCI) strategy (figure 1.5), which is a holistic approach to preventing and managing childhood diseases such as diarrhea thereby reducing child mortality (WHO, 2010).

Figure 1.5: Components of Integrated Management of Childhood Illness strategy



Source: WHO, 2010.

The IMCI approach has three major components namely: the health facility component (which aims to improve the availability of drugs and medical supplies); the health system component (which aims to improve health workers' skills); and the family and community component, which aims to improve the care-seeking behaviors of caregivers (Wamae, Kichamu, Kundu & Muhunzu, 2009).

1.3. Statement of the Problem

Kenya has had mixed results in infant, child and under-five mortality rates over the last two decades (where infant mortality rate is defined as the probability of dying before the first birthday, per 1,000 live births; child mortality rate is defined as the probability of dying between the first and fifth birthday, per 1,000 children surviving to 12 months of age; and under-five mortality rate is defined as the probability of dying between birth and the fifth birthday, per 1,000 live births). The 1993 KDHS showed that the under-five mortality rate was 101.8 per 1000 live births. In the 1998 KDHS, the under-five mortality rate had fallen to 93 per 1000 live births. This rate rose to 95 per 1000 live births by 2003 but fell significantly to 74 per 1000 live births by 2008 and then rose to 84.7 per 1000 live births in 2010. Improvements in under-five mortality indicators in the past decade have largely been due to the government's efforts in increasing the immunization coverage of children in all provinces as well as vigorous efforts to combat malaria, which is also one of the top killers of children under the age of five.

Although much progress has been made in reducing U5 mortality, the current rate of 74 per 1000 live births (which implies that 1 in every 14 children in Kenya do not get to celebrate their fifth birthday) is an indicator that a lot of work still needs to be done if the country is to meet the MDG 4 target of reducing the U5 mortality rate by two-thirds between 1990 and 2015. Whereas much attention has been given to illnesses such as malaria and programs such as immunization, diarrhea, which is easy and inexpensive to treat, continues to cut short the lives of dozens of Kenyan children every day. Box 1 shows the burden of diseases in Kenya. The box shows that diarrheal diseases cause the third biggest burden on the country's general population yet it has been neglected.

Box 1: Top 10 Causes of Death in Kenya

1. HIV/AIDS (38%)
2. Lower respiratory infections (10%)
3. Diarrheal disease (7%)
4. Tuberculosis (5%)
5. Malaria (5%)
6. Cerebrovascular disease (4%)
7. Ischaemic heart disease (4%)
8. Perinatal conditions (4%)
9. Road traffic accidents (2%)
10. Chronic obstructive pulmonary disease (2%)

Source: WHO World Health Statistics 2006

Data from the KDHS show that few children suffering from diarrhea receive the recommended treatments and a good number receive no treatment at all. In addition, not many mothers have knowledge on the four basic rules of home-based management of diarrhea which include: increasing the intake of fluids, continued feeding, provision of zinc supplements, and taking the child to a health facility if dehydration persists. For instance, only 26% of the children suffering from diarrhea in the 2008 KDHS were given increased fluids and only 29% received the same amount of foods as before.

A focus on diarrhea can play a significant role in reducing the under-five mortality rate and quicken the country's footsteps in its journey towards the realization of MDG 4. This study therefore seeks to examine the factors that influence mothers' choices of childhood diarrhea treatment in Kenya.

1.4. Research Questions

The study will address the following questions:

i. What are the most common and least common choices of diarrhea treatment for under-five children in Kenya?

ii. How does the choice of diarrhea treatment in Kenya vary with child, maternal and household factors?

iii. What are the policy implications for the management of childhood diarrheal diseases in Kenya?

1.5. Research Objectives

General objective

To identify the determinants of the choice of treatment for childhood diarrhea in Kenya

Specific objectives

The specific objectives include:

i. To describe treatment seeking patterns for childhood diarrhea in Kenya
ii. To identify child, maternal and household factors that influence the choice of childhood diarrhea treatments in Kenya
iii. To inform policy on reducing the number of under-five deaths caused by diarrhea in Kenya

1.6. Significance of the Study

The new Kenyan policy on management of diarrheal diseases recognizes the need for home-based case management. The policy guidelines state that "parents and other caretakers of children below five years of age will be empowered to give early treatment at home to children with diarrhea following the four main rules of home therapy (DCAH, MoPHS, 2010, p. 4). The importance of home-based case management in reducing mortality and morbidity caused by childhood illnesses is also highlighted in the IMCI. However, it is important to note that the effectiveness of home-based case management is highly dependent on various individual and household factors, which differ from one household to another. Specifically, the study will examine the following factors: age of the child, birth order of the child, place of birth, maternal education, age of mother at birth, household income/wealth, household size, and place of residence.

This study is significant in two main ways. First, it aims at highlighting the child, maternal and household factors that influence the choice of treatment options for a child suffering from diarrhea. These factors (and their importance) would help readers and policy makers to

understand the reasons behind disparities in care-seeking behaviors of mothers with children suffering from diarrhea. This can go a long way in developing future programs and policies aimed at eradicating childhood diarrhea. Second, the study will use econometric tools to analyze the choice of treatment options by mothers/caregivers of children suffering from diarrhea. By so doing, the study will contribute to the literature of child health economics.

1.7. Limitations of the Study

The major limitation of this study is the use of quantitative data solely, obtained from the KDHS 2008 datasets. The choice of treatment for childhood illnesses by mothers is a decision that is influenced by multiple factors, many of which are not captured by the datasets that will be used. Issues such as perception about the seriousness of the illness and religious beliefs play an important role in this decision making process but obtaining such information may require in-depth qualitative interviews with mothers. These variables are referred to as "unobservables" and even though they are missing from the model, the included variables will help to explain the choice of diarrhea treatment to some extent and the results will form the basis for future studies. The missing unobservables are however taken care of by the error term of the model.

2.0. LITERATURE REVIEW

2.1. Introduction

Many studies have been undertaken to examine the factors that influence the utilization of health services. This chapter will review theoretical as well as empirical studies on utilization of healthcare services for children under the age of five years.

2.2. Theoretical Literature

The economic theory that informs the choice of healthcare services/products given a wide range of choices is the random utility theory. The random utility theory, which is the basis for discrete choice models, differs from the classic consumer theory in various ways. First, the classic consumer theory assumes continuity of the consumption goods, which is not the case for discrete choice models. Second, classic consumer theory assumes that the consumption goods are homogenous in nature and as a result, the utility function is a function of the quantities of the goods and not of the attributes of the goods. However, the attributes of consumption goods are what determine the utility the consumers derive from consuming the goods. This led to utility being expressed as a function of attributes in the discrete choice models. Lastly, the classic consumer theory assumes that the behavior of consumers is deterministic. This differs from the discrete choice models which have the aspect of probabilistic behavior (stochasticity) of the consumers in them. There are four major sources of stochasticity in discrete choice models, which include: unobserved characteristics of the alternatives; unobserved characteristics of the individuals; errors in measurement; and omitted variables (Greene, 2000).

The random utility theory therefore models utility as a function of observable and unobservable components. Given a set of alternatives available to consumers, the utility derived from choosing one of the alternatives is given as:

$$U_{ij} = V_{ij} + \varepsilon_{ij} \quad \text{---------- 2.1}$$

Where *i* represents individuals and *j* represents the alternatives. Equation 2.1 simply states that the utility to individual *i* derived from alternative *j* is a function of the deterministic component V_{ij} and the random component $\varepsilon_{ij}$of the utility. The deterministic component is the part of the utility which is observable to the researcher, whereas the random component is that part of the

utility which is unobservable to the researcher. Equation 2.1 also shows that a discrete choice model has attributes of both the individuals and the alternatives.

Given a set of alternatives, an individual chooses that alternative that provides him/her with the highest level of utility in comparison with the other alternatives. In other words, the individual is assumed to maximize his/her utility. As an illustration, if an individual is to choose between two alternatives, k and l, he/she will choose k over l if and only if: $U_{ik} \geq U_{il}$.

2.3. Empirical Literature

This section reviews some of the empirical studies done on the determinants of choice of health services. Whereas the main focus of this study is on childhood diarrhea, the review is extended to include studies addressing utilization of child healthcare services in general.

The effect of maternal education on utilization of health services has been found to have mixed results. Some studies found a positive effect, others found a negative effect, and yet others found no effect at all. In studying the reasons why many children remained unvaccinated in an urban area of Sao Paulo in Brazil, Barreto and Rodriguez (1992) found that maternal factors – maternal age, education, and marital status – had no impact whatsoever. The researchers used a sample of children born between 1971 and 1981 and registered in FAISA, a public health system. Both qualitative and quantitative data were collected through interviews and medical records, respectively. It is important to note that the association between the dependent variable and the explanatory variables was established using a univariate analysis as well as Pearson's chi-square test. Finding no association between vaccination and the child's and mother's characteristics, the researchers concluded that the utilization of vaccination mainly depended on the ability of the health system to deliver vaccination to the target groups.

The study by Barreto and Rodrigues (1992) is contrasted by that of Desai and Alva (1998) who found that vaccination status of children is positively correlated with maternal education. Desai and Alva (1998) used panel data techniques – specifically the fixed-effects model – on data from 22 developing countries to examine if a causal relationship exists between maternal education and child health. On the one hand, they found that the effect of maternal education on infant

mortality and height-for-age (both of which are indicators of the status of child health) was only significant in very few countries. On the other hand, the effect of maternal education on children's immunization status was significant in approximately 50 percent of the countries even after controlling for individual and community effects.

A positive relationship between maternal education and child health was also found by Joshi (1994), who based his study on Nepal. Joshi argues that education influences mothers' health-seeking behavior, both at home and at health facilities, and this in turn impacts on child health. Education also empowers women with knowledge and it is this knowledge which drives them to take certain actions when faced with a health issue. The study by Joshi (1994) used a sample drawn from a rural community of Godavari from which both qualitative and quantitative data were collected. The association between the dependent variable and the explanatory variables was analyzed using logistic regression models and Pearson correlation coefficients. Joshi (1994) found that women with more years of schooling sought health services – both maternal and child health services – more actively than those with few years of schooling.

Maternal education and its effect on child health and utilization of health services may be direct or indirect. Shin (2007) found that the effect of maternal education on child health is moderated by regional differences. The researcher used data from the Peruvian Demographic and Health Survey of 2000, which he analyzed using multilevel analysis. He found that maternal education is more important for child health in poor rural areas than in prosperous urban areas. The effect of maternal education on child health is therefore more pronounced in rural areas than in urban areas. This may explain the contrasting results between the study by Barreto and Rodrigues (1992), based in an urban setting, and the study by Joshi (1994), based in a rural setting.

In some countries or areas, the perceptions of the mothers towards the etiology of childhood diseases influence the management strategies of those illnesses. Feyisetan, Asa, and Ebigbola (1997) found that the management of measles, diarrhea, and fever in Yorubaland, Nigeria was strongly influenced by mothers' perceptions towards the causes of these illnesses. For instance, mothers in this region believed that diarrhea was a way of ridding the body of impurities. As a result, some mothers undertake less feeding with the perception that everything the baby eats

will be rid of anyway. However, perceptions on the causes of illnesses vary with other maternal factors such as education, area of residence, religion, and age. The researchers collected both quantitative and qualitative data, which were analyzed using cross-tabulations and logistic regression models. They found that mother's education was positively correlated with knowledge on the etiology of the childhood illnesses mentioned earlier and consequently on utilization of child health services. With regard to mother's age, it was found that mothers below the age of 40 have more adequate knowledge on the etiology of the illnesses than mothers above 40 years. However, there was little difference in knowledge among women in the 15-39 age groups.

The effect of household wealth on child health has been studied by other researchers such as Al-Ghanim (2004) and Mahmood and Nasir (2001). Al-Ghanim (2004) conducted his study in Riyadh, Saudi Arabia, where he found that, besides other factors, income was significantly associated with the choice of health facility – whether public or private. The researcher used descriptive statistics and multivariate techniques for analysis. On the other hand, Mahmood and Nasir (2001) found that mothers with higher household possession index had children with lower risk of stunting in Pakistan. The chances of stunting in children belonging to mothers with higher household wealth were 70% lower than in children of mothers with lower household wealth. In addition, living in an urban area reduced children's chances of stunting as compared to living in a rural area. This study used ordered logistic regression and adopted the *Mosley-Chen (1984) framework* which postulates that socio-economic factors affect health outcomes through four main proximate determinants namely: demographic factors, environmental contamination, nutritional factors and health-seeking behavior.

In studying the factors that determine child health-seeking practices in Kenya, Kosimbei (2005) used a multinomial logit model on the 1998 Kenya Demographic and Health Survey and the Welfare Monitoring Survey data. The researcher was interested in examining socio-economic factors that determine parents' choice of facility for advice for childhood fever. He found that the choice of facility was significantly determined by distance to the health facility, household size, maternal education and age as well as the sex of the child. The relationship between mother's age at birth was found to take a U-shape; that is, children of very young mothers and old mothers perform poorly health-wise as compared to children born to mothers in their twenties and early

thirties. Kosimbei (2005: 13) states that "childhood mortality rates are considerably higher among children born to women in the age of around forty and lowest among children whose mothers are aged 20-29 years at the time of birth."

Burton et al. (2011) examined healthcare-seeking patterns for under-five children with infectious diseases in a rural area of Bondo district. A total of 6,223 residents in 981 households were interviewed. 14% of the under-five children in the sample had diarrhea in the two weeks preceding the survey, 44% had fever and 4% had pneumonia. The researchers used multivariate logistic regression analysis to identify the factors that were independently associated with healthcare-seeking behaviors. They found that seeking healthcare services at a health facility was associated with socioeconomic status of the household, the sex of the child, age of the child and distance to the nearest health facility. Poorer households were less likely to visit a health facility than richer households. Boys were more likely than girls to be taken to a health facility as was younger children compared to older children. Distance to the nearest health facility was a predictor for seeking help for pneumonia but not for the other two diseases.

The problem of stunting in children also attracted the attention of various scholars in Kenya. Adeladza (2009) carried out a study to examine the factors associated with child growth in Kwale, Kenya. Primary data on children aged between 12 and 23 months were collected using anthropometric methods and questionnaires which were analyzed using linear regression and univariate analysis method. The researcher found the following factors to be significantly related to the children's health status: geographical location of the household, size of the household, maternal education and occupation, and household head characteristics such as sex, religion and occupation. Of significance was the finding that occupation of mothers and household heads was an important predictor of child health status and health services utilization.

Ndiku, Jaceldo-Siegl, Singh and Sabatie (2011) carried out a study on the determinants of under-fives' food intake and nutritional status in a rural area of Eastern Kenya. They argued that under-nutrition, characterized by lack of sufficient and variety of foods remains a major public health concern in most of the developing countries. Their study mainly focused on the role of the child's sex in influencing malnutrition. A total of 403 households were surveyed and interviews

conducted with the biological mothers of the children, giving a sample of 629 children under the age of five. Using anthropometric measures, the researchers analyzed the data using descriptive tests including student's t-test for continuous variables, and Fisher's exact test and Pearson Chi-squared test for categorical variables. The study found that girls had higher prevalence of both moderate and severe malnutrition than boys in all age categories. Boys had higher energy intake than girls, an indication of intra-households' disparities in resource allocation based on child's sex.

Many studies conducted on childhood illnesses in Kenya revolve around the informal settlements of Nairobi. Some of these studies include: Breiman et al. (2011), Olack et al. (2011), and Taffa and Chepngeno (2005). The first two studies were conducted in Kibera slums. In the Olack et al.'s (2011) study, the focus was on the nutritional status of under-five children in two villages of Kibera slums. The sample size used was 1,245 children (592 males and 653 females). Similar to Ndiku et al.'s (2011) study, this study also collected anthropometric measures and used descriptive data analysis techniques such as Chi-square tests. Olack et al. (2011) found that the age group of the child influences the food and nutritional intake, with older children reporting higher rates of malnutrition than younger children. Contrary to the Nduku et al.'s study, Olack et al. found that chronic malnutrition was more prevalent in boys than in girls.

Breiman et al. (2011) also carried out their study in two villages located in Kibera slums but their focus was on health-care use for major infectious disease syndromes such as fever, diarrhea, and respiratory illnesses. The data used for this study was based on the healthcare-use survey (HUS) that had been carried out in the two villages in 2005. A total of 1,542 households with children under the age of five were included in the survey. Data was analyzed using descriptive statistics, the inverse Fisher F probability function and Chi-square test. A major finding from this study is that the amount of time spent at home by mothers (which translates into mother's occupation) was negatively associated with healthcare use for under-five children. Reasons given for this finding include: lack of income by the mothers with which to access healthcare services, and the fact that those caretakers staying with their children at home may be serving as a healthcare-use proxy, through monitoring their children's health status in the home.

Taffa and Chepngeno (2005) examined the role of socio-demographic, economic and disease-related factors in influencing health care seeking practices for children under the age of five in two slums in Nairobi (Korogocho and Viwandani). The survey included a total of 15,174 households and 3015 under-five children. Out of the 3015 children, 999 had been sick in the two weeks preceding the survey. 60.5% of the sick children were taken for medical assistance of some sort. Data was analyzed using Chi-squares test and logistic regression analysis. The researchers found that the perception of the caretakers about the lack of seriousness of the illness and lack of finances were cited as the major reasons for not seeking healthcare for the children. The age group of the child was also associated with healthcare seeking pattern, with healthcare being sought for the youngest children (aged between 0 and 11 months). Households tended to seek healthcare if the child suffered from diarrhea as compared to coughing. In addition, household income was also significantly associated with seeking healthcare but only to a particular threshold after which its impact normalized.

2.4. Overview of the Literature

The review of the above studies provides a strong case for the assertion that there are many factors besides price that influence individuals' utilization of health services. Given that children rely on others for their health status, it is important to study how child, maternal, and household factors affect utilization of child health services. The assumption here is that mothers are the primary caretakers of their children. Therefore, mothers' characteristics and the conditions in which the mothers live – household income, place of residence, availability of health facilities – also influence their utilization of child health services.

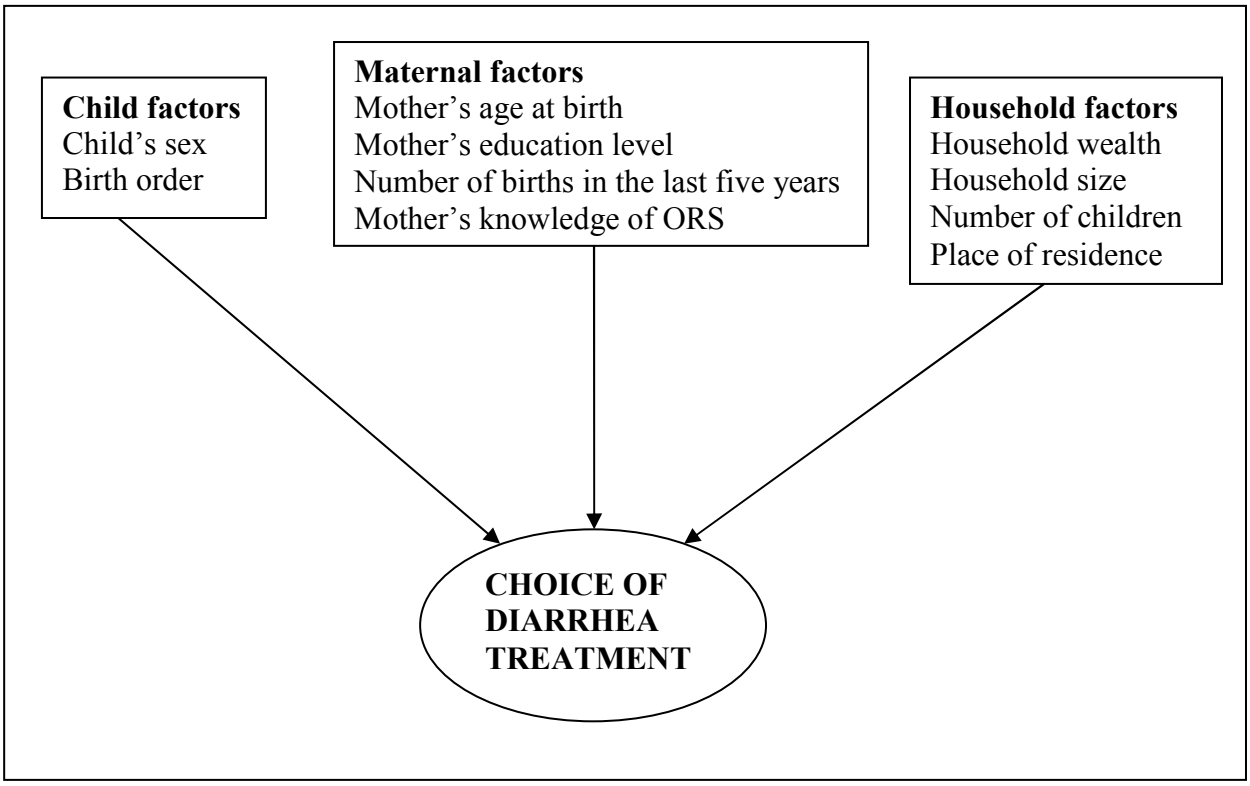
A review of the literature reveals that there is a gap in diarrhea treatment-related studies and how the choice of diarrhea treatments varies from one affected child to another. This study will therefore address this literature gap by focusing on the various diarrhea treatments available and what factors influence mothers to choose (or not choose) them.

3.0. METHODOLOGY

3.1. Conceptual Framework

The conceptual framework developed for the study was drawn from the findings of the literature review and extended to include child-related factors such as child's sex and birth order. The framework is depicted in figure 3.1 below.

Figure 3.1: Conceptual framework for determinants of choice of diarrhea treatment



Source: Researcher's own conceptualization

The framework shows that the choice of diarrhea treatment is determined by child, maternal and household factors. Among the many child factors, the study examined child's sex and birth order. The maternal factors of interest include maternal education, mother's age at birth, mother's knowledge of ORS and number of children in the last five years. On the other hand, household factors that were examined in the study include household wealth, household size, number of children, and place of residence.

3.2. Analytical Framework

3.2.1. Specification of the model

This study used the multinomial logit model (MNL). The MNL model is used when the number of choices facing an individual is more than two (Greene, 2000). This model is appropriate for this study because diarrhea treatments are numerous and mothers/caretakers are faced with a wide range of options.

The choice of the MNL over other multinomial choice models (conditional logit, multinomial probit and mixed logit models) lies in the assumptions made about the variations of the explanatory variables as well as the assumptions of the error component of the utility function for each alternative. The multinomial logit model uses explanatory variables that vary with individuals and this is what differentiates it from the conditional and mixed logit models. The multinomial logit model also assumes that the error components are extreme-value/Gumbel distributed (rather than normally distributed, which is the assumption of the multinomial probit model), and are identically and independently distributed (iid) across alternatives and observations/individuals (Greene, 2000).

The MNL, like other choice models, is founded on the *Random Utility Theory* and begins by assuming that the individual chooses an alternative from a set of alternatives that will maximize his/her utility (Greene, 2000). The utility function for each alternative contains characteristics of both the alternatives and the individuals. The utility function is given as:

$$U_{ij} = V_{ij} + \epsilon_{ij} \quad \text{----------} \quad 3.1$$

Where:

U_{ij} is the true utility of the alternative j to the decision maker i

V_{ij} is the deterministic or observable portion of the utility estimated by the researcher

ϵ_{ij} is the portion of utility unknown to the researcher

The multinomial logit model gives the choice probabilities of each alternative as a function of the deterministic portion of the utility of all the alternatives. Assuming that there are *J*

alternatives and that the dependent variable y is defined to take value j if the j^{th} alternative is chosen, then in general, the probability of choosing the jth alternative is given as:

$$\Pr(i) = \frac{\exp(V_i)}{\sum_{j=1}^{J} \exp(V_j)} \quad \text{---------- 3.2}$$

The implication of equation (3.2) is that the probability of choosing an alternative from a set of alternatives increases monotonically with an increase in the deterministic utility of that alternative but decreases with increases in the deterministic utility of each of the other alternatives (Greene, 2000).

Based on the choices of diarrhea treatments examined in this study, equation 3.2 can be re-written as:

$$\Pr(i) = \frac{\exp(V_i)}{\sum_{j=RT,OT,NT}^{3} \exp(V_j)} \quad \text{---------- 3.3}$$

Equation 3.3 simply means that the probability of choosing one of the diarrhea treatments is a function of the deterministic utility of that treatment and the sum of the deterministic utility of all the available treatments.

In practice, the deterministic component of the utility takes the form: $\beta'_j x_{ij}$. The explanatory variables do not vary with the alternatives in a MNL but they vary with individuals. Therefore, for a MNL, the probability of an individual (i) choosing one of the diarrhea treatments (j) can be re-written as:

$$\Pr(ij) = \frac{e^{\beta'_j x_i}}{\sum_{j=RT,OT,NT}^{3} e^{\beta'_j x_i}} \quad \text{---------- 3.4}$$

The problem with estimating equation 3.4 is that the model is unidentified in that there will be more than one solution to the coefficients, leading to the same probability for each of the alternatives (Greene, 2000). This problem is overcome by setting one of the coefficients equal to zero. This is equivalent to setting one of the alternatives as the reference category. In this study, the "No Treatment" alternative was set as the reference category.

Estimating a MNL is done using the Maximum Likelihood (ML) technique and therefore the parameter values obtained should be such that they maximize the log likelihood function. The likelihood function is:

$$L(\beta) = \prod_{i=1}^{N}\prod_{j=1}^{J} p_{ij}^{y_{ij}} \quad \text{----------} \quad 3.5$$

Taking the logarithm of equation 3.5 gives the log likelihood function, given as:

$$LL(\beta) = \sum_{i=1}^{N}\sum_{j=1}^{J} I_i(y_j) \ln p_{ij} \quad \text{----------} \quad 3.6$$

Where p_{ij} is similar to equation 3.4 and I_i is an indicator which takes the value of 1 if observation (y) equals a chosen alternative and 0 otherwise.

One of the assumptions of the multinomial logit model is the independence of irrelevant alternatives (IIA). This assumption states that the ratio of the probabilities of the outcome and the base categories is not affected by the presence of another alternative (Greene, 2000). The IIA assumption will be tested using the Hausman's test. If this assumption does not hold, then the MNL can no longer be used and instead the multinomial probit model becomes a more appropriate model.

Interpreting the coefficients

The coefficients obtained from the multinomial logit model explain the changes in the logarithm of the ratio between the probabilities of the outcome and the base categories as a result of a unit change in each explanatory variable:

$$\log\left[\frac{\Pr(y=outcome\ category)}{\Pr(y=base\ category)}\right] = \beta_0 + \beta_1 m.age + \beta_2 m.educ + \beta_3 m.births + \beta_4 n.ORS + \beta_5 c.sex + \beta_6 b.order + \beta_7 c.number + \beta_8 hhincome + \beta_9 hhsize + \beta_{10} res + \varepsilon \quad \text{----------} \quad 3.7$$

The sign of the estimated coefficient shows the direction of change in *the log of the risk ratio*. The risk ratio (also known as the odds ratio) is the ratio of the probability of the outcome category and the probability of the base category. The odds ratio is obtained by taking the exponent of the coefficients, which removes the logarithm from equation 3.7 and gives the ratio of the probabilities of the outcome and base categories. Coefficients with negative signs usually have odds ratio less than 1, whereas coefficients with positive signs have odds ratio greater than 1. If the odds ratio is greater than 1, that variable favors the outcome category. On the other hand, if the odds ratio is less than 1, that particular variable favors the base category (Greene, 2000).

Marginal effects

The marginal effects (also known as partial effects) are the most useful results in a multinomial logit model. Marginal effects show the change in the probabilities of each outcome category with respect to changes in the explanatory variables.

3.2.2. Estimatable Model

The model that was estimated is given in equation 3.8 below:

$$DT = f(m.age, m.educ, m.births, n.ORS, c.sex, b.order, c.number, hhincome, hhsize, res \quad ----- \quad 3.8$$

Where:

DT: diarrhea treatment

m.age: mother's age at birth

m.educ: mother's education in years

m.births: mother's number of births in the last five years

n.ORS: mother's knowledge of ORS

c.sex: child's sex

b.order: child's birth order

c.number: number of children in a household

hhincome: household income

hhsize: size of the household

res: place of residence

The dependent variable (diarrhea treatment) is a multi-choice variable and includes the following choices: recommended treatment (RT), other treatments (OT) and no treatment (NT). The OT category includes treatments such as antibiotic drugs, anti-motility drugs and herbal drugs.

3.2.3. Explanatory variables and their expected relationship with the dependent variable

The explanatory variables included: mother's age at birth, mother's educational status, number of births in last five years, mother's knowledge of ORS, child's sex, child's birth order, household income, size of the household, number of children in a household and place of residence. Table 3.1 shows the measures that will be used for each explanatory variable and their expectations with the dependent variable.

Table 3.1: Measures of explanatory variables and expected relationships

Variable	*Measure*	*Expected relationship with choice of diarrhea treatment*
m.age	The age of the mother at birth, measured as a discrete variable involving different age groups.	A U-relationship: very young and older mothers are likely not to choose any diarrhea treatment
m.educ	The number of years of schooling of the mother	A positive relationship with recommended diarrhea treatments
m.births	The number of live births a mother has had in the past five years	It is expected that more births in the last five years are associated with better ability to manage diarrhea diseases
n.ORS	Mother's knowledge of ORS	It is expected that mothers who have either heard of ORS or used it before are more likely to continue using it to manage childhood diarrhea
c.sex	The sex of the child	It is expected that mothers are more concerned about managing diarrhea in female children than in male children

b.order	A number showing the child's position of birth among his/her siblings	It is expected that mothers become better skilled at managing childhood illnesses with more births.
c.number	The number of children a household has	It is expected that households with more children are better skilled at managing childhood diarrhea than those with fewer children
hhincome	The level of income of the household. Measured by a proxy, the household wealth index, which is a discrete variable	A positive relationship with recommended diarrhea treatments. Richer households will be better off at managing childhood diarrhea than poorer households.
hhsize	The size of the household, measured by the number of children the mother has	Larger households are more likely to use recommended diarrhea treatments than smaller households
res	A discrete variable showing whether the household is located in a rural or urban area	Households living in urban areas are better able to manage childhood diarrhea than rural households.

3.3. Data Type and Analysis

This study used secondary data obtained from the Kenya Demographic and Health Survey 2008 datasets. The analysis of the data will be done in three stages:

Descriptive analysis was done to get a feel of the data used. This analysis involved computing the mean, standard deviation and frequency of the data.

Econometric analysis entailed running the multinomial logit model. At this stage, odds ratio and marginal effects were computed to give further meaning to the analysis.

Diagnostic and specification tests

Endogeneity is a potential problem and was discussed. Endogeneity arises when one of the explanatory variables is correlated with the error term, thereby violating the zero-conditional mean assumption, which states that the covariance between the explanatory variables and the error terms should be zero: $Cov\,(X,\varepsilon) = 0$ (Greene, 2000). However, this assumption may not hold and therefore the problem of endogeneity exists. The causes of endogeneity include: bias resulting from omitted explanatory variables which are equally important in explaining the dependent variable; errors in measurement of the variables; and reverse causation whereby both the dependent and explanatory variables influence each other. If the problem of endogeneity exists, then an instrument should be used for the affected explanatory variable. The instrument should be such that it is correlated with the affected explanatory variable but not with the error term (Greene, 2000). However, this is only possible in linear models but impossible in non-linear models. Other approaches have been suggested for non-linear models.

Lastly, the *likelihood ratio (LR) test* was used to gauge whether or not the explanatory variables are jointly informative. The LR test is the equivalent of the F-test in the ordinary least squares estimation. Data analysis was conducted using STATA statistical software.

4.0. RESULTS AND DISCUSSION

4.1. Introduction

This chapter presents the results of the analysis undertaken as well as a discussion of the findings in comparison with the findings from the literature review. Specifically, the results are on the descriptive statistics carried out, the multinomial logit model, odds ratio as well as the marginal effects. The diagnostic test and specification test are also discussed.

4.2. Diagnostic test

The diagnostic test entailed the need to test for the endogeneity problem in the model. The instrumental variable approach is the recommended remedy for endogeneity in linear models. The challenge of this test in a non-linear model was highlighted in chapter 3. For discrete choice models, three approaches have been proposed in the literature and include: the two-stage Berry, Levinsohn and Pakes (BLP) method, the control function approach, and the unobservable instruments approach. This study used the unobservable instruments approach to address the problem of endogeneity. In this study, the variable that was "potentially endogenous" is the mother's knowledge of oral rehydration salts (ORS). This is because a mother's knowledge of ORS will influence her use of oral rehydration therapy. Similarly, a mother's use of oral rehydration therapy would enhance her knowledge of ORS. The two variables therefore have some sort of correlation. In order to address this potential endogeneity issue, the mother's education level was included as an explanatory variable and as the most suitable unobservable instrument for mother's knowledge of ORS.

4.3. Specification test

The test used to examine whether or not the model was correctly specified was the Likelihood Ratio (LR) test. The multinomial logit estimation resulted in a maximized log likelihood of -354.99646. This test of joint significance of the effect of predictors has a statistically significant chi-square statistic of 605.24 (with a probability of 0.000). A significant log-likelihood chi square statistic implies that the model with coefficients from the predictors is a better improvement of the model with the intercept only. In other words, this means that the child, mother and household characteristics used in the model are jointly important determinants of the choice of diarrhea treatment by households.

4.4. Descriptive Statistics

After data exploration and cleaning, the final sample size was 771 children under the age of five years who had suffered from diarrhea in the two weeks preceding the KDHS 2008 survey. Tables 4.1 and 4.2 show the demographic and socio-economic characteristics of the sample. The sample included children who had not been administered with any treatment, children who had been administered with recommended treatment, and those who had been administered with other types of treatment, specifically: antibiotics, anti-motility drugs, and herbal medicine.

Table 4.1: Demographic-socio-economic characteristics of the households (continuous variables)

Variable	*Obs.*	*Mean*	*Std. Dev.*	*Min*	*Max*
Mother's age	771	27.35279	6.698909	15	49
Mother's education	771	5.516213	4.03661	0	22
Household size	771	6.230869	2.665047	2	19
No. of children	771	2.040208	0.9560155	0	6
No. of births in last five years	771	1.754864	0.730299	1	5

Table 4.1 shows that the mothers in the sample were aged between 15 and 49 years with the average age of 27 years. The highest years of schooling of the mothers was 22 years while the mothers with the lowest educational level had not attended any schooling at all. The mean number of years of schooling was 5.5 years. The largest household had 19 members while the smallest had only 2 members, with the average household comprising of 6 members. The households with the most number of children had 6 children while others lacked any children; however, the mean number of children in a household was 2. Lastly, the highest number of births to the mothers in the sample in the five years preceding the survey was 5 children, while the lowest was one child. On average, though, mothers in the sample had given birth to 2 children in the 5 years leading to the survey.

Table 4.2: Demographic-socio-economic characteristics of the households and children (discrete variables)

Variable	*Freq.*	*Percent*
Type of place of residence		
urban	179	23.22
rural	592	76.78
Wealth index		
poorest	280	36.32
poorer	135	17.51
middle	111	14.40
richer	132	17.12
richest	113	14.66
Sex of child		
male	413	53.57
female	358	46.43

Table 4.2 shows that majority of the participants in the sample (76.78 percent) came from rural settings while only 23.22 percent were from an urban setting. The majority of the respondents in the sample are categorized as "poorest" (36.32 percent), followed by "poorer", "richer", "richest" and lastly "middle" in as far as wealth index is concerned. Majority of the children in the sample were male (53.6 percent), with females making up 46.4 percent of the sample.

Patterns of Use of Diarrhea Treatments

A Note on Zinc

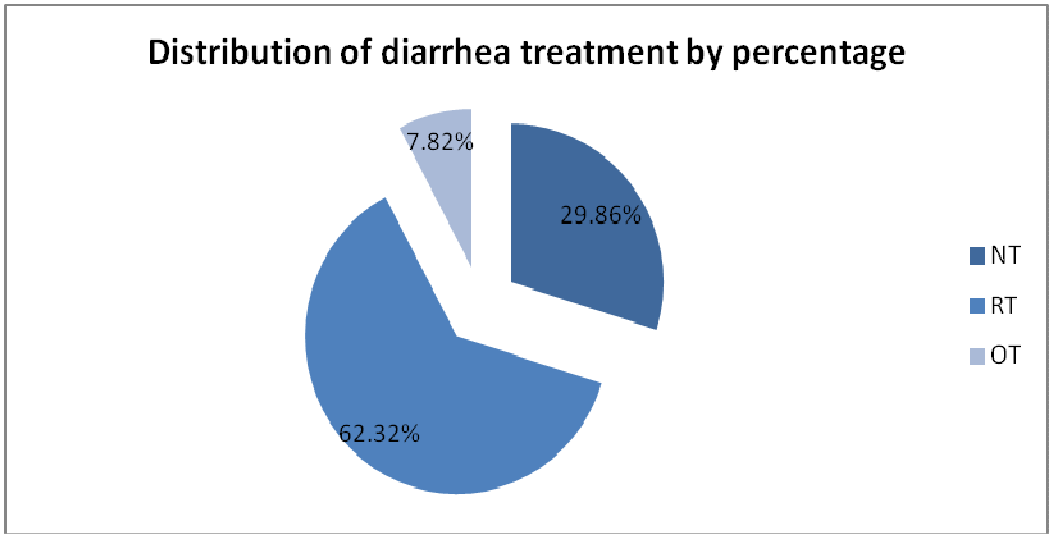
Only four of the 771 under-5 children who had diarrhea during the two weeks preceding the 2008 KDHS were administered with zinc. This shows that at the time, zinc had not become popular in managing diarrhea despite its recommendation by the World Health Organization.

Recommended and Other Treatments

Figure 4.1 shows the distribution of the three categories of diarrhea treatment investigated by the study. The figure shows that 62.32% of the children were administered with recommended treatment while only 7.82 percent were administered with other treatments (antibiotics, anti-

motility drugs, and herbal medicine). 29.86% of the children were not administered with any sort of treatment.

Fig. 4.1: Distribution of diarrhea treatment categories



A Note on Knowledge and Usage of Oral Rehydration Salts

Knowledge of ORS is a key determinant of its use. It is important to determine the status of knowledge of ORS among mothers with children below the age of 5.

Fig. 4.2: Mother's knowledge and usage of oral rehydration salts

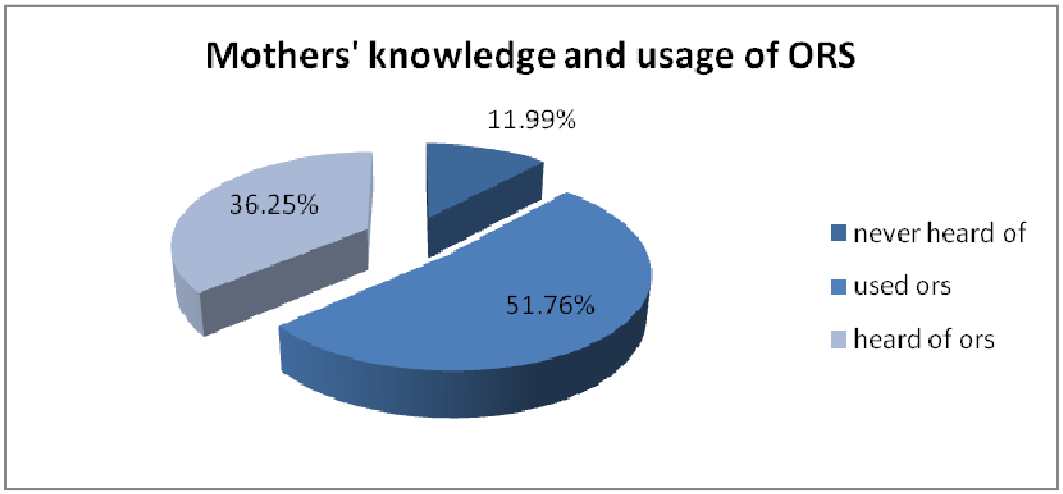


Figure 4.2 shows that 11.99% of the mothers in the sample had never heard of oral rehydration salts. More than half of the mothers (51.76%) had used ORS and a further 36.25% had heard of ORS but had never used it.

4.5. Regression Results

The results provided by the descriptive statistics only give a general picture of the study sample and how it varies depending on the variables of interest. Regression analysis was carried out to show how the choice of diarrhea treatments was influenced by different household, maternal and child characteristics. In this case, a multinomial logit model was run to model the dependent variable (which comprised of three categories of diarrhea treatment, namely: Recommended Treatment, Other Treatments, and No Treatment) against a number of explanatory variables. The results are shown and discussed in the following section.

4.5.1. Multinomial logit results

The results obtained from running equation 3.8 using the multinomial logit model are shown in table 4.3. The coefficients explain the changes in the log of the ratio between the probabilities of the outcome and the base categories as a result of a unit change in each explanatory variable. Like in all multinomial logit models, one of the categories is usually set as the base category and acts as the reference category. In this study, the "No Treatment" category was set as the base category hence the results only give two outcomes: the "Recommended Treatment" and the "Other Treatments" categories.

Table 4.3: Multinomial logit results (z statistics in parentheses)

Variables	**Recommended Treatment**	**Other Treatments**
Age	.117208 (0.84)	.4454691** (2.14)
Agesq	-.0012282 (-0.52)	-.0078968** (-2.17)
Res_2 (rural)	.7637046* (1.64)	-1.509455*** (-3.13)
Educ	.0792042* (1.89)	-.0164651 (-0.31)
Hhold_size	.0371229 (0.62)	0683562 (0.91)
Children_no	-.0003795 (-0.00)	.0149718 (0.07)
Wealth_2 (poorer)	.237886 (0.63)	.8054248 (1.61)
Wealth_3 (middle)	.3775442 (0.82)	1.280928** (2.27)
Wealth_4 (richer)	-.2906192 (-0.66)	.2520733 (0.42)
Wealth_5 (richest)	.7482041 (1.25)	-.6948657 (-0.88)
Births	-.1441536 (-0.62)	-1.008885*** (-3.21)
Heard_ORS_1 (used ors)	5.30405*** (10.04)	.0718145 (0.08)
Heard_ORS_2 (heard of ors)	-.3595971 (-1.19)	-.0989621 (-0.26)
Bord	-.0608441 (-0.62)	.1154206 (0.90)
Childsex_2 (female)	.2462044 (0.99)	.1454324 (0.46)
Constant	-4.04086 (-2.01)	-5.682435 (-1.98)
**** (**) * Parameter was statistically significant at the 0.01(0.05) and 0.10 level respectively*		
Number of obs. = 771: Iteration = 6: log likelihood = -354.99646: LR $chi^2(30)$ = 605.24, Prob>chi^2 = 0.000: Pseudo R^2 = 0.4602		

Recommended Treatment

In the first output, the Recommended Treatment is the outcome category while the No Treatment is the base category. Three variables are statistically significant for this output: place of

residence, mother's education level, and mother's knowledge of ORS. Living in a rural area increases the log of the ratio of the probability of using RT vis-à-vis probability of NT by 0.76 compared to living in an urban area. Place of residence is statistically significant at 0.10 level

The number of years of schooling of mothers increases the log of the ratio of the probability of using ORT vis-à-vis probability of using no treatment by 0.079. The mother's schooling level is statistically significant at 0.10 level of significance. Lastly, having used ORS in the past increases the log of the ratio of the probability of using RT vis-à-vis probability of NT by 5.3 compared to having not heard of ORS before. Previous usage of ORS is statistically significant at 0.01 significance level.

Other Treatments

In the second output, the "Other Treatments" is the outcome category while the No Treatment is the base category. For this output, four explanatory variables are statistically significant: mother's age, place of residence, household wealth, and the number of births in the last five years. Mother's age increases the log of the ratio of the probability of using OT vis-à-vis probability of NT by 0.4. However, after squaring the mother's age, it reduces the log of the ratio of the probability of using OT vis-à-vis probability of NT by 0.01. This implies that younger and older mothers are more likely to use no treatment for managing their children's diarrhea than mothers in the middle age groups. Both the age variables are statistically significant at 0.05 significance level.

Living in a rural area reduces the log of the ratio of the probability of using other treatments vis-à-vis probability of using no treatment by 1.5 compared to living in an urban area; this variable is statistically significant at 0.01 significance level. Being in the middle wealth category increases the log of the ratio of the probability of using OT vis-à-vis probability of NT by 1.28 compared to being in the poorest wealth category. This variable is statistically significant at 0.05 significance level. Having more births in a span of five years reduces the log of the ratio of the probability of using other treatments vis-à-vis probability of using no treatment by 1.01; this variable is statistically significant at 0.01 significance level.

4.5.2. Odds ratio results

Besides the basic multinomial logit, odds ratio were also computed to give further meaning to the results. The odds ratio results are shown in table 4.4.

Table 4.4: Odds ratio results (z statistics in parentheses)

Variables	Recommended Treatment	Other Treatments
Age	1.124353 (0.84)	1.561222** (2.14)
Agesq	.9987725 (-0.52)	.9921343** (-2.17)
Res_2 (rural)	2.146212* (1.64)	.2210305*** (-3.13)
Educ	1.082425* (1.89)	.9836697 (-0.31)
Hhold_size	1.037821 (0.62)	1.070747 (0.91)
Children_no	.9996206 (-0.00)	1.015084 (0.07)
Wealth_2 (poorer)	1.264641 (0.63)	2.237647 1.61)
Wealth_3 (middle)	1.458698 (0.82)	3.599978** (2.27)
Wealth_4 (richer)	.7478004 (-0.66)	1.28669 (0.42)
Wealth_5 (richest)	2.113202 (1.25)	.4991415 (-0.88)
Births	.8657547 (-0.62)	.3646254*** (-3.21)
Heard_ORS_1 (used ors)	201.1498*** (10.04)	1.074456 (0.08)
Heard_ORS_2 (heard of ors)	.6979575 (-1.19)	.905777 (-0.26)
Bord	.9409699 (-0.62)	1.122345 (0.90)
Childsex_2 (female)	1.279161 (0.99)	1.155258 (0.46)
**** (**) * Parameter was statistically significant at the 0.01(0.05) and 0.10 level respectively*		
Number of obs. = 771: Iteration = 6: log likelihood = -354.99646: LR $chi^2(30)$ = 605.24, Prob>chi^2 = 0.000: Pseudo R^2 = 0.4602		

The odds ratio is the ratio between the probability of the outcome category and the probability of the base category. Odds ratios are obtained by taking the exponents of the coefficients shown in table 4.3. An odds ratio greater than 1 implies that that particular variable favors the outcome category whereas an odds ratio less than 1 implies that the variable favors the base category.

Recommended Treatment

Like in the multinomial logit results, only three variables are statistically significant. Living in a rural area increases the ratio of the probability of RT vis-à-vis the probability of NT by 2.15 times as compared to living in an urban area. This implies that living in a rural area favors the use of RT.

A mother's level of schooling increases the ratio of the probability of RT vis-à-vis the probability of NT by 1.08 times, implying that a mother's level of education influences her to use ORT rather than no treatment at all. Lastly, having used ORS previously increases the ratio of the probability of RT vis-à-vis the probability of NT by 201.15 times, implying that previous encounter with ORS is a determining factor of current usage of RT as compared to lack of encounter with ORS.

Other Treatments

Four variables are statistically significant for this outcome. A mother's age increases the ratio of the probability of OT vis-à-vis the probability of No Treatment by 1.56 times, implying that older mothers are more likely to use some kind of treatment for childhood diarrhea rather than no treatment as compared to younger mothers. However, the age squared variable increases the ratio of the probability of using OT vis-à-vis the probability of NT by only 0.99 times.

Living in a rural area increases the ratio of the probability of OT vis-à-vis the probability of NT by 0.22 times, which implies that this variable favors the base category. The implication is that mothers in rural areas are more likely to not use any treatment than to use anti-biotics, antimotility drugs or herbal medicines for their children suffering from diarrhea.

Being in the middle class of wealth increases the ratio of the probability of OT vis-à-vis the probability of NT by 3.6 times compared to being in the poorest class of wealth. The implication is that households in the middle category of wealth are more likely to use some kind of treatment (anti-biotics, antimotility drugs or herbal medicines) for childhood diarrhea rather than no treatment at all compared to households in the poorest wealth category.

Lastly, the number of births given in a span of five years increases the ratio of the probability of OT vis-à-vis the probability of NT by 0.36 times, meaning that this variable favors the base category. The implication is that mothers who have more children delivered within a span of five years are more likely to not give any form of treatment to a child suffering from diarrhea than some form of treatment such as anti-biotics, antimotility drugs or herbal medicines.

4.5.3. Marginal effects results

Most importantly, marginal effects were computed for each outcome to show how the probability of choosing each category of diarrhea treatment is influenced by the explanatory variables. Table 4.5 gives the results for the marginal effects of a change in the probability of an outcome as a result of a change in an explanatory variable. For continuous variables, the change is calculated from a threshold, usually the mean. This is not the case for discrete variables, which are usually treated as dummy variables.

Table 4.5: Marginal effects after multinomial logit (z statistics in parentheses)

Variables	No Treatment	Recommended Treatments	Other Treatments
Age	-.0144052 (-0.92)	.0053528 (0.29)	.0090524 (1.40)
Agesq	.0001623 (0.62)	.0000175 (0.06)	-.0001798 (-1.54)
*Res_2 (rural)**	-.077206 (-1.24)	.1865487** (2.18)	-.1093427** (-2.12)
Educ	-.0086183* (-1.79)	.010858* (1.98)	-.0022397 (-1.34)
Hhold_size	-.0043068 (-0.65)	.0033542 (0.44)	.0009526 (0.46)
Children_no	-.0000111 (-0.00)	-.0003917 (-0.02)	.0004027 (0.06)
*Wealth_2 (poorer)**	-.272311 (-0.75)	.0080366 (0.17)	.0191945 (0.91)
*Wealth_3 (middle)**	-.421951 (-1.04)	.0069776 (0.12)	.0352175 (1.12)
*Wealth_4 (richer)**	.0326245 (0.59)	-.0481249 (-0.73)	.0155004 (0.66)
*Wealth_5 (richest)**	-.673365 (-1.42)	.0914746* (1.76)	-.024138* (-1.79)
Births	.0193375 (0.75)	.0039305 (0.13)	-.023268** (-2.02)
*Heard_ORS_1 (used ors)**	-.6085378*** (-16.17)	.7304108*** (21.30)	-.121873*** (-4.83)
*Heard_ORS_2 (heard of ors)**	.0412128 (1.12)	-.0469035 (-1.11)	.0056907 (0.49)
Bord	.0062592 (0.57)	-.0106849 (-0.84)	.0044257 (1.15)
*Childsex_2 (female)**	-.0273233 (-0.99)	.0291392 (0.92)	-.0018159 (-0.21)
The asterix (*) on the variable represents discrete change of a dummy variable from 0 to 1 **** (**) * Parameter was statistically significant at the 0.01(0.05) and 0.10 level respectively*			

Place of residence

Living in a rural area increases the probability of using recommended treatment by 18.65 percent, but it reduces the probability of using other diarrhea treatments by 10.93 percent. This finding however contradicts prior expectations as well as conventional knowledge on the role

played by place of residence in the utilization of recommended treatments. It is expected that people living in urban areas are more exposed and have access to sources of information which enable them to utilize the required treatments. The finding of this study could be as a result of the nature of the sample used, which disproportionately favored rural areas. Majority of the participants in the sample (76.78 percent) were from rural areas.

Mother's education level

Mothers with more years of schooling have a 1.08 percent higher probability of using recommended treatment than those with fewer years of schooling. On the other hand, mothers with more years of schooling have 0.86 percent lower chances of not using any treatment for childhood diarrhea than mothers with fewer years of schooling.

Household wealth

The richest households have a 9.15 percent higher probability of using recommended treatment than the poorest households. On the other hand, the richest households have a 2.19 percent lower chance of using other treatments than the poorest households.

Births in the last five years

Mothers who have more births in a span of five years (from a mean of 2 births) have a 2.33 percent lower chance of using other types of diarrhea treatment than mothers with fewer births.

Knowledge of ORS

Mothers who have used ORS previously have a 60.85 percent lower chance of not using any treatment compared to mothers who have never heard of ORS before. Similarly, mothers with past experience of ORS have a 12.19 percent lower chance of using other types of diarrhea treatment compared to mothers who have never heard of ORS before. Most importantly, mothers with past experience of ORS have 73.04 percent higher chances of using recommended treatment compared to mothers who have never heard of ORS before.

4.6. Discussion of Findings

A mother's age is important only for other types of diarrhea treatment but not for recommended treatment. This finding on mother's age-RT relationship supports the work of Barreto and Rodriguez (1992) who found no association between mothers' age and utilization of vaccination services. On the other hand, the influence of mother's age at birth on utilization of other types of diarrhea treatment is similar to the finding by Kosimbei (2005) and Feyisetan, Asa, and Ebigbola (1997), and in particular the U-shape relationship.

A mother's level of education is important only for recommended treatment but not for other types of diarrhea treatment. The positive relationship between mother's education level and utilization of recommended treatment supports the works of Desai and Alva (1998), Joshi (1994), Feyisetan, Asa, and Ebigbola (1997), Kosimbei (2005) and Adeladza (2009). On the other hand, the lack of a positive relationship between mother's education level and use of other treatments for diarrhea equally supports the work of Barreto and Rodriguez (1992)

The place of residence is important for all sorts of diarrhea treatment. However, there is disparity in the type of residence's importance for the type of diarrhea treatment. For RT, living in a rural area is more important than living in an urban area. On the other hand, for other types of treatment, living in an urban area is more important than living in a rural area. These disparities could be an indication of issues to do with accessibility and availability of drugs. Other studies support this finding on the effect of place of residence on utilization of childhood healthcare services and include: Shin (2007), Mahmood and Nasir (2001), and Adeladza (2009).

Knowledge of ORS is very important for RT utilization. This result is similar to the finding by Feyisetan, Asa, and Ebigbola (1997) who found that mothers who had knowledge on the etiology of childhood illnesses were highly likely to utilize healthcare services. However, such knowledge was found to be positively correlated with mothers' level of education.

Household wealth is only important for other types of treatment but not for RT. This makes sense because RT (particularly ORT) is a cheap and cost-effective treatment compared to other types of diarrhea treatment. The positive effect of household wealth on childhood health services

utilization supports the works of Al-Ghanim (2004), Mahmood and Nasir (2001), Taffa and Chepngeno (2005), and Breiman et al. (2011) who equally found a positive correlation between the two variables.

The number of births in the last five years is important for other types of treatment but not for recommended treatment. None of the literatures reviewed supports this finding.

5.0. SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1. Summary

The study sought to find out the choice of treatments for childhood diarrhea by households in Kenya and what factors influence such a choice. The main treatments of interest were zinc and oral rehydration therapy, which are the recommended treatments for managing childhood diarrhea by the World Health Organization. A multinomial logit model was used to model household choices of treatment given three categories of treatment: ORT, other treatments (antibiotic drugs, anti-motility drugs and herbal medicines) and no treatment at all.

The main findings from the study include: first, zinc (although recommended by WHO and implemented as a policy by the country's Ministry of Health) remains largely unutilized by most households in the country. Of the 771 under-5 children who suffered from diarrhea in the initial sample, only 4 were administered with zinc. This could be an indication of lack of information among mothers and caretakers of the importance of zinc in managing childhood diarrhea and preventing re-occurrence.

Second, utilization of recommended treatment for childhood diarrhea is influenced by maternal and household factors but not by child factors. Specifically, maternal education, prior knowledge of/or experience with oral rehydration salts (ORS), and living in a rural area are strong determinants of utilization of ORT. Of these three factors, prior knowledge/experience of ORS is the most important determining factor. On the other hand, utilization of other types of treatment (antibiotics, anti-motility drugs and herbal medicine) is influenced by mother's age at birth, living in an urban area, household wealth and number of births delivered in a span of five years.

Third, and a crucial observation, is the fact that many households do not administer any sort of treatment whatsoever to children suffering from diarrhea. Of the 771 children who had diarrhea in the initial sample, 29.86 percent were not administered with any type of treatment. This could be an indication of the perception by many mothers and caretakers towards the illness. It could be that they do not perceive diarrhea to be a serious illness. The problem therefore could be lack of awareness among mothers and caregivers of the seriousness of diarrhea in children.

5.2. Policy Recommendations

5.2.1. The need to create awareness on childhood diarrhea

The Ministry of Health has tried to create awareness on childhood diseases in the country among them diarrhea. However, it seems from the study, that the level of awareness creation on diarrhea has been inadequate and hence there is need to intensify awareness among mothers/caregivers on the seriousness of childhood diarrhea, particularly in rural areas. There is also the need to increase awareness on management of the illness through the WHO-recommended treatments, ORT and zinc supplements, which are cheap and can easily be prepared at home using readily available ingredients (this applies only to ORT and not zinc). Intensifying awareness can be done through mass education programs and the use of the mass media to inform the public. In rural areas, it can also be done through the use of public health officials on a door-to-door basis. This is particularly important given that studies show that people in rural areas do not visit health facilities as frequently as those in urban areas. It is therefore the government's responsibility to reach to the rural people through outreach activities.

5.2.2. The need to increase the availability and accessibility of zinc

Zinc is important in managing childhood diarrhea because it not only minimizes the severity of the illness but also it reduces the duration and possible recurrence of the illness in future. Besides lack of awareness on zinc, the under-utilization of the supplement could be an indication of problems with availability and accessibility. Thus, besides strengthening awareness on zinc, the MOH could further increase its availability and accessibility by increasing its stock and offering them free of charge in public hospitals.

5.3. Areas for Future Investigation

As earlier alluded to, the major limitation of this study was the use of quantitative data solely, obtained from the KDHS 2008 datasets. The choice of treatment for childhood illnesses by mothers is a decision that is influenced by multiple factors, as shown in the literature review. Unfortunately, many of these factors were not captured by the datasets that were used. Issues such as perception about the seriousness of the illness and religious beliefs are believed to play an important role in this decision making process but obtaining such information requires in-

depth qualitative interviews with mothers. It is proposed that future studies should be conducted using primary data that would capture a wide variety of factors that are likely to influence mothers/caregivers' choice of diarrhea treatment. This would help to capture the unobservables and achieve better results given that these variables are equally important in explaining the problem under investigation. Future studies should also take into account the supply side of the problem, that is, perceptions of healthcare providers on barriers to utilization of recommended treatments for childhood diarrhea.

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APPENDIX

APPENDIX A: REGRESSION RESULTS

Multinomial Logit Model

```
. xi:mlogit diarr_treatment age agesq i.res educ hhold_size children_no i.wealth births i.heard_ORT bord i.childsex, base(0)
i.res             _Ires_1-2           (naturally coded; _Ires_1 omitted)
i.wealth          _Iwealth_1-5        (naturally coded; _Iwealth_1 omitted)
i.heard_ORT       _Iheard_ORT_0-2     (naturally coded; _Iheard_ORT_0 omitted)
i.childsex        _Ichildsex_1-2      (naturally coded; _Ichildsex_1 omitted)

Iteration 0:   log likelihood = -657.61566
Iteration 1:   log likelihood =   -393.376
Iteration 2:   log likelihood = -362.42133
Iteration 3:   log likelihood = -355.84414
Iteration 4:   log likelihood = -355.02198
Iteration 5:   log likelihood =  -354.9965
Iteration 6:   log likelihood = -354.99646

Multinomial logistic regression                 Number of obs   =        771
                                                LR chi2(30)     =     605.24
                                                Prob > chi2     =     0.0000
Log likelihood = -354.99646                     Pseudo R2       =     0.4602
```

diarr_trea~t	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
ORT						
age	.117208	.1403263	0.84	0.404	-.1578265	.3922425
agesq	-.0012282	.0023526	-0.52	0.602	-.0058392	.0033827
_Ires_2	.7637046	.4657266	1.64	0.101	-.1491028	1.676512
educ	.0792042	.0418376	1.89	0.058	-.002796	.1612045
hhold_size	.0371229	.0600021	0.62	0.536	-.0804791	.1547249
children_no	-.0003795	.1928899	-0.00	0.998	-.3784367	.3776777
_Iwealth_2	.2347886	.3715002	0.63	0.527	-.4933385	.9629157
_Iwealth_3	.3775442	.4607309	0.82	0.413	-.5254717	1.28056
_Iwealth_4	-.2906192	.4420082	-0.66	0.511	-1.156939	.5757009
_Iwealth_5	.7482041	.6006019	1.25	0.213	-.4289539	1.925362
births	-.1441536	.2310773	-0.62	0.533	-.5970568	.3087496
_Iheard_OR~1	5.30405	.5284486	10.04	0.000	4.268309	6.33979
_Iheard_OR~2	-.3595971	.302117	-1.19	0.234	-.9517355	.2325414
bord	-.0608441	.098283	-0.62	0.536	-.2534752	.131787
_Ichildsex_2	.2462044	.2483934	0.99	0.322	-.2406378	.7330466
_cons	-4.04086	2.010492	-2.01	0.044	-7.981352	-.1003678
others						
age	.4454691	.208153	2.14	0.032	.0374967	.8534414
agesq	-.0078968	.0036321	-2.17	0.030	-.0150156	-.0007781
_Ires_2	-1.509455	.4828834	-3.13	0.002	-2.455889	-.5630207
educ	-.0164651	.0539318	-0.31	0.760	-.1221695	.0892392
hhold_size	.0683562	.0751425	0.91	0.363	-.0789203	.2156328
children_no	.0149718	.2301813	0.07	0.948	-.4361754	.4661189
_Iwealth_2	.8054248	.5015594	1.61	0.108	-.1776135	1.788463
_Iwealth_3	1.280928	.5633663	2.27	0.023	.1767501	2.385106
_Iwealth_4	.2520733	.6010836	0.42	0.675	-.926029	1.430175
_Iwealth_5	-.6948657	.7901706	-0.88	0.379	-2.243572	.8538403
births	-1.008885	.3146934	-3.21	0.001	-1.625672	-.392097
_Iheard_OR~1	.0718145	.9329061	0.08	0.939	-1.756648	1.900277
_Iheard_OR~2	-.0989621	.3805308	-0.26	0.795	-.8447887	.6468644
bord	.1154206	.1286662	0.90	0.370	-.1367606	.3676018
_Ichildsex_2	.144324	.3137162	0.46	0.645	-.4705485	.7591965
_cons	-5.682435	2.875393	-1.98	0.048	-11.3181	-.0467673

(diarr_treatment==no_treatment is the base outcome)

Odds Ratios

```
. mlogit, rrr

Multinomial logistic regression                 Number of obs   =        771
                                                LR chi2(30)     =     605.24
                                                Prob > chi2     =     0.0000
Log likelihood = -354.99646                     Pseudo R2       =     0.4602
```

diarr_trea~t	RRR	Std. Err.	z	P>|z|	[95% Conf.	Interval]
ORT						
age	1.124353	.1577763	0.84	0.404	.853998	1.480297
agesq	.9987725	.0023497	-0.52	0.602	.9941778	1.003388
_Ires_2	2.146212	.9995483	1.64	0.101	.8614805	5.346874
educ	1.082425	.0452861	1.89	0.058	.9972079	1.174925
hhold_size	1.037821	.0622715	0.62	0.536	.9226742	1.167337
children_no	.9996206	.1928167	-0.00	0.998	.6849313	1.458893
_Iwealth_2	1.264641	.4698146	0.63	0.527	.6105846	2.619323
_Iwealth_3	1.458698	.6720672	0.82	0.413	.5912764	3.598655
_Iwealth_4	.7478004	.3305339	-0.66	0.511	.3144472	1.778377
_Iwealth_5	2.113202	1.269193	1.25	0.213	.65119	6.857631
births	.8657547	.2000563	-0.62	0.533	.5504293	1.361721
_Iheard_OR~1	201.1498	106.2973	10.04	0.000	71.40083	566.6774
_Iheard_OR~2	.6979575	.2108648	-1.19	0.234	.3860704	1.261803
bord	.9409699	.0924813	-0.62	0.536	.776099	1.140865
_Ichildsex_2	1.279161	.3177352	0.99	0.322	.7861263	2.081412
others						
age	1.561222	.3249731	2.14	0.032	1.038209	2.347712
agesq	.9921343	.0036035	-2.17	0.030	.9850966	.9992222
_Ires_2	.2210305	.1067319	-3.13	0.002	.0857869	.5694862
educ	.9836697	.053051	-0.31	0.760	.8849984	1.093342
hhold_size	1.070747	.0804586	0.91	0.363	.9241135	1.240647
children_no	1.015084	.2336535	0.07	0.948	.6465043	1.593797
_Iwealth_2	2.237647	1.122313	1.61	0.108	.8372659	5.980254
_Iwealth_3	3.599978	2.028107	2.27	0.023	1.193333	10.86021
_Iwealth_4	1.28669	.7734084	0.42	0.675	.3961236	4.179432
_Iwealth_5	.4991415	.3944069	-0.88	0.379	.1060789	2.348649
births	.3646254	.1147452	-3.21	0.001	.1967793	.6756386
_Iheard_OR~1	1.074456	1.002367	0.08	0.939	.1726226	6.687746
_Iheard_OR~2	.905777	.344676	-0.26	0.795	.4296481	1.909544
bord	1.122345	.1444079	0.90	0.370	.872179	1.444267
_Ichildsex_2	1.155258	.3624233	0.46	0.645	.6246595	2.136559

(diarr_treatment==no_treatment is the base outcome)

Marginal effects

```
. mfx, predict(outcome(0))

Marginal effects after mlogit
      y  = Pr(diarr_treatment==0) (predict, outcome(0))
         =  .12994232
```

variable	dy/dx	Std. Err.	z	P>|z|	[95% C.I.]		X
age	-.0144052	.01569	-0.92	0.359	-.045157	.016346	27.3528
agesq	.0001623	.00026	0.62	0.535	-.000351	.000675	792.992
_Ires_2*	-.077206	.06251	-1.24	0.217	-.199722	.04531	.767834
educ	-.0086183	.00482	-1.79	0.074	-.018066	.00083	5.51621
hhold_~e	-.0043068	.00667	-0.65	0.519	-.017386	.008772	6.23087
childr~o	-.0000111	.02136	-0.00	1.000	-.041883	.04186	2.04021
_Iweal~2*	-.0272311	.03641	-0.75	0.455	-.0986	.044138	.175097
_Iweal~3*	-.0421951	.04065	-1.04	0.299	-.121874	.037484	.143969
_Iweal~4*	.0326245	.05533	0.59	0.555	-.075813	.141062	.171206
_Iweal~5*	-.0673365	.04729	-1.42	0.155	-.160032	.025359	.146563
births	.0193375	.02578	0.75	0.453	-.03119	.069865	1.75486
_Ihear~1*	-.6085378	.03764	-16.17	0.000	-.682311	-.534765	.520104
_Ihear~2*	.0412128	.03665	1.12	0.261	-.030611	.113036	.360571
bord	.0062592	.01097	0.57	0.568	-.015238	.027756	3.62905
_Ichil~2*	-.0273233	.02758	-0.99	0.322	-.081374	.026727	.464332

(*) dy/dx is for discrete change of dummy variable from 0 to 1

```
. mfx, predict(outcome(1))

Marginal effects after mlogit
      y  = Pr(diarr_treatment==1) (predict, outcome(1))
         =  .84300405
```

variable	dy/dx	Std. Err.	z	P>|z|	[95% C.I.]		X
age	.0053528	.01842	0.29	0.771	-.030759	.041464	27.3528
agesq	.0000175	.00031	0.06	0.955	-.000589	.000624	792.992
_Ires_2*	.1865487	.08563	2.18	0.029	.018716	.354381	.767834
educ	.010858	.00549	1.98	0.048	.000101	.021615	5.51621
hhold_~e	.0033542	.00765	0.44	0.661	-.011645	.018354	6.23087
childr~o	-.0003917	.02463	-0.02	0.987	-.048663	.047879	2.04021
_Iweal~2*	.0080366	.04734	0.17	0.865	-.084749	.100822	.175097
_Iweal~3*	.0069776	.05871	0.12	0.905	-.108099	.122054	.143969
_Iweal~4*	-.0481249	.06621	-0.73	0.467	-.177895	.081645	.171206
_Iweal~5*	.0914746	.05193	1.76	0.078	-.0103	.193249	.146563
births	.0039305	.03024	0.13	0.897	-.05533	.063191	1.75486
_Ihear~1*	.7304108	.03429	21.30	0.000	.663197	.797624	.520104
_Ihear~2*	-.0469035	.04214	-1.11	0.266	-.129501	.035694	.360571
bord	-.0106849	.01265	-0.84	0.398	-.035483	.014113	3.62905
_Ichil~2*	.0291392	.03181	0.92	0.360	-.033199	.091478	.464332

(*) dy/dx is for discrete change of dummy variable from 0 to 1

```
. mfx, predict(outcome(2))

Marginal effects after mlogit
      y  = Pr(diarr_treatment==2) (predict, outcome(2))
         =  .02705363
```

variable	dy/dx	Std. Err.	z	P>|z|	[95% C.I.]		X
age	.0090524	.00648	1.40	0.162	-.003641	.021746	27.3528
agesq	-.0001798	.00012	-1.54	0.123	-.000408	.000049	792.992
_Ires_2*	-.1093427	.05156	-2.12	0.034	-.210392	-.008293	.767834
educ	-.0022397	.00167	-1.34	0.179	-.005505	.001026	5.51621
hhold_~e	.0009526	.00208	0.46	0.647	-.003128	.005033	6.23087
childr~o	.0004027	.00645	0.06	0.950	-.012246	.013051	2.04021
_Iweal~2*	.0191945	.02101	0.91	0.361	-.021982	.060371	.175097
_Iweal~3*	.0352175	.03144	1.12	0.263	-.026411	.096846	.143969
_Iweal~4*	.0155004	.02348	0.66	0.509	-.030522	.061523	.171206
_Iweal~5*	-.024138	.01347	-1.79	0.073	-.050548	.002272	.146563
births	-.023268	.0115	-2.02	0.043	-.045808	-.000728	1.75486
_Ihear~1*	-.121873	.02526	-4.83	0.000	-.171377	-.072369	.520104
_Ihear~2*	.0056907	.01156	0.49	0.623	-.016967	.028349	.360571
bord	.0044257	.00385	1.15	0.250	-.003114	.011965	3.62905
_Ichil~2*	-.0018159	.00875	-0.21	0.836	-.018974	.015343	.464332

(*) dy/dx is for discrete change of dummy variable from 0 to 1