FACTORS ASSOCIATED WITH DIARRHEA AMONG UNDER-FIVE CHILDREN IN ZAMBIA

BY

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I, Dr. Gershom Chongwe,

Having supervised and read this dissertation is satisfied that this original work of the author under whose name it is being presented.

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CERTIFICATE OF APPROVAL

This dissertation by **Hellen N. Hamangaba** is approved in partial fulfillment of the requirements for the award of the Master of Science in Epidemiology by the University of Zambia.

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1. ……	**……**
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DEDICATION

This dissertation is dedicated to my husband Francis, my mother Alice, and my lovely children Francis Jr, Miriam and Joy for their love and support during the entire time of my studies. Special dedication also goes to GOD almighty for the everlasting love he has for me.

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LIST OF ACRONYMS

AIDS	:	Acquired Immune-Deficiency Syndrome
AOR	:	Adjusted Odds Ratio
CBOH	:	Central Board of Health
CI	:	Confidence Interval
CSO	:	Central Statistical Office
EA	:	Enumeration Areas
HIV	:	Human Immuno-Deficiency Virus
IMCI	:	Integrated Management of Childhood Illnesses
MDGs	:	Millennium Development Goals
MoH	:	Ministry of Health
OR	:	Odds Ratio
SDGs	:	Sustainable Development Goals
TDRC	:	Tropical Diseases Research Centre
UN	:	United Nations
UNICEF	:	United Nations International Children's Emergency Fund
UNZA	:	University Of Zambia
UNZABREC	:	University of Zambia Biomedical Research Committee
UTH	:	University Teaching Hospital
WHO	:	World Health Organization
ZDHS	:	Zambia Demographic Health Survey

ABSTRACT

Background

Diarrhea is one of the leading causes of morbidity and mortality, especially among under-five children. Globally, as many as 800,000 children die each year from severe dehydration resulting from diarrhea, with most deaths occurring in developing countries including sub-Saharan region. In Zambia, the 2013-14 ZDHS report showed prevalence of diarrhea being 16% among under-five children and approximately, 15,000 Zambian children under- five years suffer at least three or more episodes of diarrhea every year.

The aim of this study was to determine the factors associated with diarrhea among under-five children in Zambia.

Methods

This was a secondary analysis of the ZDHS 2013-14. A data set with a total of 12,634 children aged between 0-59 months from the women's questionnaire was analyzed for factors associated with diarrhea. A weighted analysis using STATA version 12 was used. Association between outcome and independent variables was done using Pearson's chi-square test. Univariate and multivariate analyses were done. In order to control for possible confounding, multiple logistic regression was applied.

Results

The study showed that age of children [AOR = 2.55, CI (0 .80-0 .91)], vaccination status [AOR = 2.18, CI (1.55-3.10)], residence [AOR = 0.70, CI (0.59-0.84)], mother's education [AOR = 1.61, CI (0.42-0.89)] and water source [AOR = 0.91, CI (0.09-0.85)] were risk factors associated with diarrhea among the under-five children, after adjusting for other variables.

Conclusion

Absence of education among mothers and rural residence contributed more to the prevalence of diarrhea than those with primary education above. Implementing and monitoring well-packaged health education and promotion protocols and improving sanitation would reduce diarrhea morbidity and mortality in Zambia

CHAPTER ONE

1.0 BACKGROUND

Diarrhea is one of the leading causes of morbidity and mortality, especially among children under the age of five years. Globally, as many as 800,000 children die each year from diarrhea, with most deaths occurring in developing countries (Bhutta. A.Z, 2013). Diarrhea is defined as the passage of three or more watery or loose stools per day, or more frequent passage than is normal for an individual. This is contrary to passage of frequent formed stools or the loose pasty stools passed by breast fed babies. It is both preventable and treatable. It is also a leading cause of malnutrition in children under five years old (WHO, 2013).

Diarrheal disease affects human life both in developed and developing countries. Acute diarrhea is one of the main problems affecting children under- five in the world, reducing their well-being, and this leads to a considerable demand for health care services. Despite the fact that it affects both developed and developing countries, it is evident that there is a strong relationship between diarrhea, poverty and unhygienic environmental conditions (Mohammed.S, 2013).

According to statistics by World Health Organization (2013), children under three years of age in developing countries experience on average about three episodes of diarrhea every year. As a result diarrhea is a major cause of malnutrition, and the most severe threat posed by diarrhea is dehydration. Death can follow severe dehydration if the lost body fluids and electrolytes are not replenished. A Significant proportion of diarrhea can be prevented through safe drinking water, good sanitation and hygiene.

Diarrhea can be caused by numerous pathogens and transmitted through multiple vehicles. Some of the most common pathogenic causes of severe and fatal diarrhea in young children globally are rotavirus and shigella. Rotavirus takes the lives of over 3,600 children under five years and accounts for approximately 40% of all deaths caused by diarrhea (CIDRZ, 2013).

Risk factors for diarrhea among children include age, sex, geographic location, drinking from unprotected water supply and household economic status. While poor sanitation, limited access to potable water, inappropriate breast feeding practices contribute to the burden of the disease,

there continues to be the need to further document the socio-demographic correlates of diarrhea in order to inform policy and programmatic interventions that have potential to stem the prevalence of the disease (Siziya et al, 2013).

Many studies including cohort and case control studies on diarrhea and associated factors have been done in developed and undeveloped (developing countries) and most of them were based on small hospital and community based studies. Furthermore, the prevalence and correlates of diarrhea may vary with season, geographical area and between countries (Siziya et al, 2013).

Persons living in developing countries with poor access to safe water, sanitation, or hygiene infrastructure have increased risk of exposure to viral, bacterial and parasitic pathogens that can cause diarrheal diseases (Rohmawati, 2010).

Inappropriate child feeding practices has also a major public health problem resulting in series of social and economic consequences especially in developing countries.

In Zambia, the prevalence of diarrhea is at 16% (non-bloody), and 3% (bloody) second to fever (21%) among the children under-five years (CSO, 2014). Approximately, 15,000 Zambian children under- five years suffer at least three or more episodes of diarrhea every year (Chilambwe et al, 2014) Identifying the causes of diarrhea is very crucial for the effective implementation of child health intervention programs for policy formulation and the general assessment of resource requirements and intervention prioritization in any nation. Therefore, this study was conducted to identify the risk factors for the occurrence of childhood diarrhea among children aged between 0–59 months in Zambia. No study has been done in Zambia that utilized the ZDHS 2013-14 survey data to investigate the factors associated with diarrhea among under-five children.

Hence, the aim of this study was to assess the factors associated with childhood diarrhea using a large sample size from a community -based survey. This gives high power to the results obtained from the study because of the sample size, (Rowe et al, 2008). This dissertation has other sections including methods, results, discussion, conclusion, and limitations.

1.1 STATEMENT OF THE PROBLEM

Diarrhea is still responsible for high rates of mortality in children worldwide. Reducing child mortality is the 4th of the United Nations Millennium Development Goals (MDGs). The Millennium Development Goals recognize child health and survival as an important socio-development issue. It is estimated that one in ten children dies before the first birthday, and one in five before their fifth birthday (UNICEF, 2013). However, despite advances it was reported that at the current pace, the world would not meet the MDG target (UNICEF, 2013). In place of these goals, the United Nations (UN) came up with 17 sustainable development goals (SDGs) to transform our world by 2030. Some of the goals are important for this study as they address some of the variables that were identified to be determinants of diarrhea. Goal three emphasizes good health and well-being for all at all ages, goal four emphasizes quality education, goal six emphasizes clean water and sanitation and goal one which emphasizes no poverty.

The problem of diarrhea is a more complex problem in most of the low income countries due to increasing poverty levels (CIDRZ, 2013). An outstanding feature of diarrheal diseases in the developing world is that the frequency is more during and after the weaning period (Himonga, 1996). The number of diarrheal cases is still on the increase in many countries, especially in the sub-Saharan region, Zambia inclusive. Global organizations like World Health organization (WHO) and United Nations (UN) have put up a number of strategies and treatment procedures to control under-five child morbidity and mortality, which have been adopted by many countries.

Strategies like the Integrated Management of Childhood Illnesses (IMCI) strategy was introduced in Zambia in 1995 by the Central Board of Health (CBOH) in collaboration with other cooperating partners like, United Nations International Children's Emergency Fund (UNICEF) and World Health Organization (WHO) (Chitembo, 2003). "One of the 16 key family practices promoted within IMCI is to dispose of feces safely, and wash hands with soap and water after defecation and before preparing meals and feeding children" (WaterAid, 2009). In principle therefore, sanitation should be adequately addressed within IMCI. However, in resource-poor context the preventive health elements of IMCI have been marginalized as over-stretched and under-resourced health workers are faced with long queues of sick patients outside their health centre.

This marginalization of the preventive measures against diarrhea such as sanitation has led to a reduced effectiveness of health systems and poor global progress on Millennium Development Goal (MDG4) number four (WaterAid, 2009).

Sanitation and hygiene are both essential barriers that prevent the transmission of disease by the fecal-oral route. Sanitation in particular has not been given adequate consideration by health policy makers despite evidence of its cost-effectiveness. Currently, there are almost one billion people without safe water and a staggering 2.5 billion without adequate sanitation. Faster and more cost-effective reductions in child mortality would be achieved in the long-term by promoting sanitation alongside safe drinking water as well as expanding ORT coverage and the other interventions (WaterAid, 2009).

The lack of targeting at the global level recurs at the national level. While Zambia has made significant reductions in child mortality over the last 10 years, financial flows are not addressing child survival priorities adequately. The Ministry of Health notes that "over 80% of the health conditions presented at health institutions in Zambia are diseases related to poor environmental sanitation", yet environmental health is given little priority in its budgeting (MoH, 2010).

There is evidence that in Zambia the under-five diarrheal disease is still a public health concern as has been shown by the Zambia Demographic Health Survey (ZDHS) 2013-14 report. According to the 2007 ZDHS report, diarrhea was reported to be at 16% (CSO, 2007). The current ZDHS report also states that diarrhea is second (16%) cause of morbidity and mortality, the first being fever of all types at 21% (CSO, 20140). This called for concern as it indicated health systems failure and poverty which are contributing factors to the problem of diarrhea among under-five children.

1.2 JUSTIFICATION/RATIONALE

Since it has been shown that diarrhea has continued to be a public health problem globally, UN decided to introduce 17 sustainable development goals (SDGs) which were adopted by many countries to end poverty, protect the planet and ensure prosperity for all. Goal three (3) states that we need to ensure healthy lives and promote well-being for all at all ages. Reducing the prevalence of diarrhea is part of this goal as it focuses on health promotion for all. Therefore, the study sought to identify the factors that are associated with its occurrence among children under

the age of five years. The factors identified would help in strengthening the implementation of already existing policies, revising them as well as dissemination of health promotion messages to all.

1.3 RESEARCH QUESTION

What factors are associated with diarrhea among under-five children in Zambia?

1.4 OBJECTIVES

1.4.1 General objective

- To examine the factors associated with diarrhea among under-five children in Zambia using data collected in the 2013-14 ZDHS.

1.4.2 Specific objectives

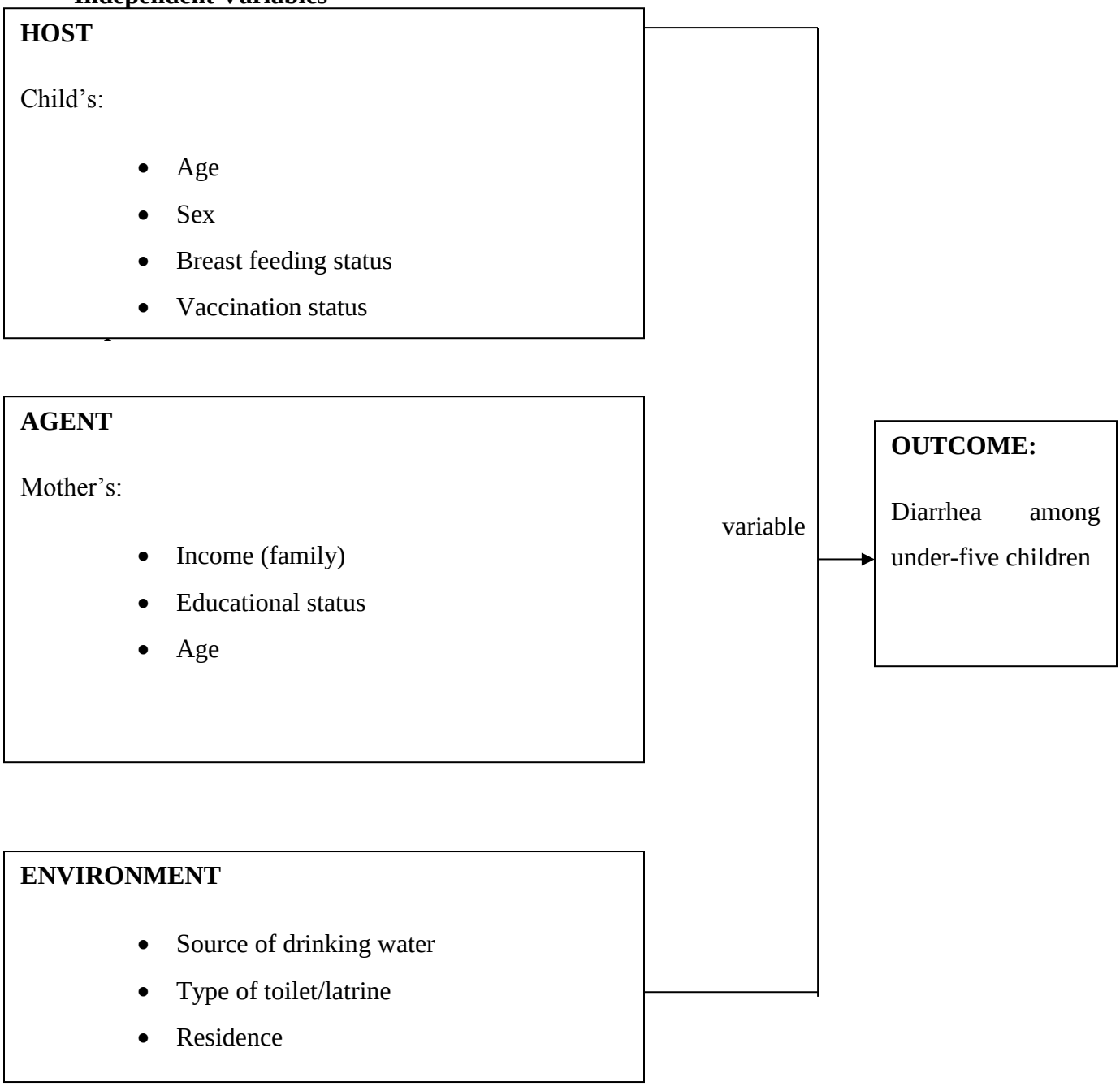
1. To explore the association of children's socio-demographic characteristics with diarrhea among under-five children in Zambia.
2. To determine the association of mother's socio-economic characteristics with diarrhea among under-five children in Zambia.
3. To explore the association between environmental factors and diarrhea among under-five children in Zambia.

1.5 CONCEPTUAL FRAMEWORK

Diarrhea is one of the communicable childhood diseases caused by various organisms which include viruses, bacteria, and parasites. The transmission of diarrhea is through consumption of contaminated food and water by the host. It can be food-borne or water-borne. "In children the symptoms of diarrhea are as a result of relationship between the infectious agents (viruses, bacteria and parasites), the host immune system and the supporting environmental factors and management imposed on the host" (Harding, 2005).

In this study the host is the under-five child, the agent is the mother as the caretaker of the under-five child, and the environment is the household physical conditions which include toilet facility, residence, and source of drinking water.

FIGURE 1: Conceptual framework



Harding, J. C. (2005)

CHAPTER TWO

2.0 LITERATURE REVIEW

Diarrhea is a leading cause of illness and death, especially in developing countries (Okeke, 2009). A lot of studies on diarrhea have been done in other countries concerning the factors associated with diarrhea among children under-five years. In Zambia studies have been done including the ZDH Surveys that are conducted every 5 to 6 years where information on diarrhea is also captured (CSO, 2014).

2.1 GLOBAL PERSPECTIVE ON BURDEN OF DIARRHEA

A study was conducted by Agustina (2013) in Indonesia which sought to determine the association between hygiene, socio-economic status and diarrhea in young children. It was a cross sectional study that was conducted on 274 randomly selected children aged 12-59 months in selected low socio-economic urban areas of East Jakarta, Indonesia. The results showed that one third of households had low income and had high incidence of diarrhea among children under the age of five and that 4.5% of children less than two years were more susceptible to diarrhea than those above two years (Agustina, 2013).

Romahwati (2010) analyzed the 2007 Indonesia national socio-economic health survey of that country. A number of factors were investigated to evaluate their association with the development of diarrhea among under- five children. The factors included host factors like child's age, sex, breast feeding status, immunization status and general nutrition status (Rohmawati, 2010).

In Bengal, risk factors for diarrhea among children under-five were analyzed by Gupta (2014). Factors that were analyzed included child's age, breast feeding method, immunization status and nutritional status. Findings of the study revealed demographic features, feeding practices, immunization practices, and nutritional status as risk factors of diarrhea, which can be tackled by effective education of the community. "Overall prevalence of diarrhea was 22.36%; 21.73% males and 22.89% females were affected with diarrhea. There were 57.69% diarrhea cases in children of 7-12 months age group, followed by 25.71% in those of 13-24 months age group; with increasing age, the prevalence of diarrhea gradually decreased" (Gupta, 2014).

In another survey study that was done in Malaysia by Amal (2011) on risk factors of diarrhea, a cross sectional design was used for the survey. The study investigated socio demographics and their influence on diarrhea. "The results showed that those with less monthly income had the highest level of incidence of diarrhea (5.5%), those who lived in rural areas had a higher level of incidence of diarrhea (62%), and the ethnic group in that part of the country (East Malaysia) had the highest level of diarrhea (5.8%)" (Amal, 2011).

In Thailand, a secondary analysis study of Thailand multiple indicator cluster survey on factors associated with diarrhea among children less than 5 years old was done. Wilunda (2009) argued that 9.8% of diarrhea was among children from poorest wealth index, 12% was in households with poor sanitary conditions, 6.7% in households that had more than one under-five children, 6% was in households with richest wealth (Wilunda, 2009).

Another study was conducted in Pakistan by Zaman (2011) on different factors affecting diarrhea among children under-five years. The results showed that age and sex of the child were significantly associated with occurrence of diarrhea among children under-five at p-value 0.05 alpha (Zaman et al, 2011).

Ghasemi et al., (2013) conducted a study on knowledge of mothers on management of diarrhea in under-five children in Kashan, Iran. The study found that 28.8% of the women had knowledge on diarrhea and its management, 46.5% had medium knowledge while 24.7 suffered low knowledge. The study concluded that mothers who were studied had inadequate knowledge about diagnosis and treatment of diarrhea (Ghasemi et al., 2013).

In Salvador, a city in north-eastern Brazil, a study was conducted on a hierarchical model for studying risk factors for childhood diarrhea by Ferrer et al, 2008. Results were that "socio-economic factors contributed most to determining diarrhea occurrence, followed by interpersonal contact, while factors related to food preparation, the environment and water and sanitation made a smaller contribution" (Ferrer et al, 2008). The findings were concluded to have interpersonal contact to be the highest factor on the hierarchical levels.

2.2 AFRICAN PERSPECTIVE ON BURDEN OF DIARRHEA

Teferra et al (2013) conducted a study in North-western Ethiopia on determinants of diarrhea among under-five children. The results of the study showed that 3.5% of households with no toilet facility had risk of diarrhea among children, 1.85 of women with no education had higher chance of diarrhea in their children, and 1.9% of children aged 6-23 months were affected (Teffera, 2014).

A study was conducted in Mzimba, Malawi where environmental, demographic and socio-economic factors were analyzed in relation to diarrhea morbidity and mortality (Chipeta, 2003). Results were that 60.3% of the children lived in poor sanitary environments, 72.1% had poor food hygiene and 80.4% had poor sources of drinking water (Chipeta, 2003).

A study was conducted in south Sudan on correlates of diarrhea among children below the age of 5 years in Sudan by Siziya et al (2011) which was a secondary data analysis of the Sudan multiple cluster indicators survey II (MICS II) conducted in 2000. The study showed that 58.8% of the mothers had no formal education, about half of the respondents lived in rural areas, majority had the poorest wealth index (quintile), slightly over a third had no toilet facility, 72% of the children had incomplete vaccination status, and 27.8% were reported to have had diarrhea the previous two weeks to the survey (Siziya, 2011).

Mengistie et al 2011 conducted a study on prevalence of diarrhea and associated risk factors among children under-five years of age in Eastern Ethiopia. The study was conducted in Kersa Demographic Surveillance and Health Research Center (KDS-HRC) filed site, located in eastern Ethiopia. The results showed that prevalence of diarrhea was 24.6% in households that did not have good sanitary conditions, 3% 0f the cases were in the rural area, and 3% were under 2 years (Mengistie, 2013).

Sayed et al 2013 conducted a study on effects of socio-economic status on infectious diarrhea in Egyptian children. Children were put in three groups where they were analyzed from. The data were collected by personal interview with each child's mother. The factors that were assessed were as follows: mother's age, father's age, family homeland, number of family members, and their education. The results showed that majority of the mothers were illiterate (30, 38.9 and

44.2% for 1st, 2nd and 3rd groups respectively). Majority of the children with diarrhea were females, (53.1%) (Sayed, 2014).

In Addis Ababa, Ethiopia a study was conducted on the determinants of under-five childhood diarrhea. It was a case control study involving 117 cases and 233 controls. The results showed that age of the children, maternal education, supplementary feeding commencing time and hand washing after cleaning child bottom were significantly associated with the risk of diarrhea (Zeleke & Alemu, 2014).

Etiology of diarrhea in children younger than five years of age admitted in a rural hospital of Mozambique was done. The study sought to look at the causative organisms of diarrhea among this age group and which category age was affected the most by diarrhea. The findings were that most organisms were present among children above 12 months old (Mandomando et al, 2007).

In Kenya a study that was conducted in 2003 on epidemiology of sporadic diarrhea in rural western Kenya. It was a laboratory-based surveillance and case control study to characterize the epidemiology of diarrhea. The results showed an increased risk of diarrhea among multiple households that shared pit latrines and those that drank water from Lake Victoria (Brooks et al., 2003).

In Uganda, a study on determinants of acute diarrhea in children aged 0- 5 were carried out by Ssenyonga et al., 2009. It was a cross-sectional study using the 2000/2001 Uganda Demographic Health Survey (UDHS) dataset. Information was derived from the women's questionnaire done on sampled mothers aged 15-49.years and with living children aged 0-5years. Results showed overall prevalence of diarrhea as 23%, with the highest prevalence being in the Northern and Eastern parts of the country. A conclusion was that factors associated with diarrhea included age group below two years, residence, and having fever within the two weeks before the survey (Ssenyonga et al., 2009).

A study to assess social and geographic dimensions on prevalence of diarrhea was done in Benin by Pande et al., in 2008. Factors like access to clean water, good hygiene practices and geographical location were assessed. The study demonstrated that households with clean water source and good hygiene practices had lesser chance of experiencing diarrhea frequently.

Regarding geographical cause it was indicated that diarrhea prevalence varies with ground water availability and quality across Benin (Pande et al, 2008).

A systematic review of diarrhea duration and severity in children and adults in low and middle income countries was done. Data was collected on diarrhea morbidity and disability among children and adults worldwide. The results concluded that 35.2% of the children in the low income countries had moderate to severe diarrhea while 64.8% had mild diarrhea. Therefore the study concluded that mild episodes of diarrhea constituted a substantial proportion among the children under-five years(Lamberti, 2012).

In Zambia a study was conducted by Irena et al (2011) on diarrhea as a major killer of children with severe malnutrition. The study was conducted on in-patients at UTH where factors like age, sex, HIV status, and nutrition status were assessed. The results showed that the majority of children with diarrhea were boys, 38.9% had HIV, and 67.3% with diarrhea also had malnutrition. It was concluded that diarrhea is associated with malnutrition and also causes dehydration (Irena et al, 2011).

Another study conducted in Namwala district of Zambia investigated correlates of diarrhea that were investigated (i.e. educational level of care givers, water quality, poor disposal of baby's stool, hand washing practice and child's age). Among these correlates, the study showed that poor disposal of baby's stool, poor hand hygiene and contaminated sources of water were associated with increase of diarrhea cases in the area (Hamuganyu, 2014).

Sakala, Mbewe and Baboo analyzed rural areas that were serviced by WASHE (Water, Sanitation, Hygiene and Sanitation) and those that were not in Monze from 2008 to 2012. It was to determine the impact of WASHE program on the incidence of diarrhea in WASHE serviced areas. The findings were that "an increase in the number of latrines and hand-washing facilities reduced the incidence of diarrhea per 1000 cases by 0.026 and 0.075 respectively, with p-values of 0.002 and 0.045 correspondingly" (Sakala, Mbewe and Baboo p. 234).

In 2007 a study was conducted by Oyat. The study was to determine the effects of environmental sanitation and water on diarrhea in children under the age of five years in Misisi compound, Lusaka. The study compared cases and controls and a number of factors were analyzed including child's age, immunization status, feeding practices, source of drinking water, type of toilet

facility, solid waste disposal and family income status. “About 72.1% of the respondents (cases) were observed to have poor sanitary conditions as compared to 65.5% of their control counterparts”. The study concluded that poor environmental health was associated with watery diarrhea in children less than five years in Misisi compound (Oyat, 2007:p.60).

Trykker et al (1994) conducted a baseline survey in a rural district of Choma, Zambia. It was focused on immunization, diarrhea incidence and treatment, sanitation and children nutrition status. Results showed that “79% of children aged12-23 months were fully immunized, the incidence of diarrhea was high and estimated at 4.8 episodes per child per year, and treatment with Oral Rehydration Salts (ORS) was used in 52% of cases. About 2/3 of the households had no safe water supply or pit latrine and only a few had a refuse pit. Only about 40% of children aged 12-2 months and 75% of those aged 24-59 months were adequately nourished”. It was concluded that the district needed intensified sanitary and nutritional programmes, and periodic baseline surveys of 2-3 years intervals (Trykker et al, 1994:p147-51).

CHAPTER THREE

3.0 METHODOLOGY

3.1 STUDY DESIGN

This was a cross-sectional study using data from ZDHS 2013-14 dataset. The study was aimed at providing an analysis of the influence that various factors have on diarrhea prevalence in Zambia. The study sought to determine which factors contributed the most to the existing prevalence statistics on diarrhea using the 2013-14 ZDHS data set. The survey's design had calculation of estimates for a wide range of socio-economic indicators at national level, urban and rural levels. According to the report, this was the first survey to be conducted at such low levels. Data was extracted from the ZDHS data set, from the Central Statistics Office, Zambia. According to the 2010 census report, the population of the country was at 13,092,666 (CSO, 2012).

3.2 THE ZDHS DATA SET

The ZDHS report is an implementation of the Central Statistical Office (CSO) in partnership with the Ministry of Health, University Teaching Hospital (UTH) virology lab, the Tropical Diseases Research Centre (TDRC), and the department of population studies at the University of Zambia (UNZA). It is conducted every five years to provide policy makers with detailed information on demographic and health characteristics of the citizens.

The ZDHS 2014 obtained information on some of the child health indicators which included fever, diarrhea, and respiratory infections. Diarrhea was one of the major health concerns in the survey which called for the need for analysis.

3.2.1 The ZDHS 2014 sample design

This study used the sampling method based on the one used by the ZDHS. The survey used a two-stage stratified cluster sample with enumeration areas (or clusters) selected during the first stage and households selected during the second stage. In the first stage 722 enumeration areas were selected with 305 in urban areas and 417 in rural areas. Prior to the selection, enumeration

areas were stratified by province then into urban and rural. Then a complete listing of households in each selected cluster, along with mapping exercise was done.

Households for enumeration were selected in the second stage using a complete list of households which served as the sampling frame for the selection. An average of 25 households was selected in every enumeration area (EA). A total of 2,815,897 households were selected for the survey. During the second stage of selection, a representative sample of 18,052 households was selected. All women age 15-49 and men age 15-49 who were either permanent residents of the households or visitors present in the households on the night before the survey were eligible to be interviewed using the individual questionnaire. In the households that were selected 12,634 children aged 5 years or younger were analyzed for diarrhea.

Three questionnaires were used in this survey; the household questionnaire, woman's questionnaire, and man's questionnaire. The three instruments were based on the questionnaires developed by the demographic health surveys programme and adapted to Zambia's specific data needs. The questionnaires were translated into seven major languages: Bemba, Kaonde, Lozi, Lunda, Luvale, Nyanja and Tonga (CSO, 2014).

The main objective was to provide information on levels and trends on fertility, childhood mortality, use of family planning methods, maternal and child health indicators including HIV/AIDS (CSO, 2014).

The primary objectives of the 2013-14 ZDHS were:-

- To collect up-to date information on fertility, infant and child mortality, and family planning.
- To collect information on health- related matters such as breastfeeding, ante natal care, children's, and childhood diseases.
- To assess knowledge on contraceptive practices among women.
- To assess the nutritional status of mothers and children.
- To improve understanding of variations in HIV Sero-prevalence levels according to social and economic characteristics and behavioral risk factors.
- To estimate levels of HIV prevalence in the general population of adults.
- To estimate unmet need for antiretroviral treatment (CSO, 2013-14).

Since the study was aimed at analyzing the secondary data on diarrhea among under-five children from the survey, a total of 12,634 children aged between 0-59 months that were included in the survey were analyzed, and women aged between 15-49years were also analyzed according to the variables of concern.

3.3 DIARRHEA DETERMINANTS DESIGN

The study was based on diarrhea data collected in the ZDHS and focused on the children that were reported on. The population for this study was children under-five years that were surveyed in the ZDHS data set, 2013-14. These children were aged between 0-59 months and were either permanent residents of the households in the sample or visitors present in the household on the night before the survey. The data was derived from section five of the women's questionnaire in the ZDHS, which looks at child health. Questions considered in answering the objectives of the study were those that were focused on in the survey and were in line with the conceptual model used.

3.4 INCLUSION CRITERIA

Included in this analysis were all the children sampled in the survey aged between 0-59 months, who had responses on whether they had an episode of diarrhea or not within the two weeks preceding the survey interview. The responses were extracted from women's questionnaire of the ZDHS, on mothers aged between 15-49 years.

3.5 EXCLUSION CRITERIA

- Children aged between 0-59 months that were analyzed for other diseases were not included in this study because it focused on diarrhea only.
- Respondents with incompletely answered questionnaires.

3.6 DATA EXTRACTION AND CLEANING

All the information that was needed for the study was obtained from the ZDHS 2013-14 data set woman's questionnaire that was used. The variables of interest for the study were kept for the data cleaning process. The outcome variable was diarrhea which was defined as diarrhea during the last two weeks prior to the survey.

The predictor variables were checked for completeness. Only those with complete information were considered for analysis. The variables that were checked for completeness included children's age, sex, breast feeding status, mothers' age, family income, education level, literacy, water source, toilet facility and residence.

TABLE 1: Summary of Variables

Type of Variable	**Variable**	**Indicator**	**Measurement scale**
Dependent	Diarrhea	Yes, no	Binary
I**ndependent**	Child's age	Age in months	Continuous
	Sex	Male, female	Binary
	Vaccination status	Complete, incomplete	categorical
	Breast feeding	Yes, no	Binary
	Residence	Urban, rural	Categorical
	Toilet facility	Shared, not shared	Categorical
	Source of drinking water	Improved, not improved	Categorical
	Mother's Education	No education, primary, secondary, above secondary	Ordinal
	Mothers' age categories	Age in years	Categorical
	Income	Lowest, second, middle, fourth, highest	Ordinal

3.7 DATA SAMPLING

The sample size included all the children and women who met the inclusion and exclusion criteria. The ZDHS sampling method has been described in the previous section (3.1.1). The women were included as they were the respondents who gave information on the children, and some of the variables were concerning them.

3.8 DATA ANALYSIS

Data analysis was done using Stata version 12.0 SE (Stata Corporation, college station, Texas). A weighted survey analysis was done as this was survey data. Initially descriptive statistics were used to describe the study variables. Chi-square test was used to examine associations of the study variables with a cut-off point of $p \leq 0.05$ and 95 % confidence interval. In this case the outcome variable diarrhea was cross tabulated with all the other study variables. Unadjusted logistic regression was done and set at p-value of 0.05 and 95 % confidence interval. Then multiple logistic regressions was done for adjusted estimates to control for confounding at p-value of 0.05 and 95 % confidence interval. Then variables with $p \geq 0.05$ were removed one at a time using stepwise regression until only the significant variables remained. The analyzed information was then summarized using tables and graphs.

3.9 ETHICAL CONSIDERATIONS

Ethics approval (ref 012-07-15B) was obtained from UNZABREC (University of Zambia Biomedical Research Ethics Committee). Anonymity and confidentiality were maintained as there was no direct contact with the respondents as the study used secondary data. The information was only used for the purpose of this study and was not shared with any other individual or organization. The results of this study can be used to improve policies and enhance future research as a manuscript will be submitted to a peer reviewed journal for publication.

CHAPTER FOUR

4.0 RESULTS

4.1 DESCRIPTIVE STATISTICS OF FACTORS ASSOCIATED WITH DIARRHEA IN UNDER-FIVE CHILDREN

Table shows the distribution of socio-demographic factors of the participants by frequency. A total of 12,634 children under five years of age were analyzed. Of these 50.74% were males. About 2,030 children were reported to have had an episode of diarrhea during this period representing 16.1% while 83.90% did not have diarrhea. About 65.83% lived in the rural areas of the country. Close to a third (34.50%) of the children came from households with shared toilet facilities. Over half (59.98%) the study population had unprotected drinking water sources. Only 12.61% of the families were in the richest wealth index, while the poorest and poorer categories were 23.77% and 23.89% respectively. The mean age was 24 months.

TABLE 2: frequency distribution of background characteristics of the participants

Characteristics (N=12,634)	Frequency	Percent (%)
Sex		
Male	6,393	50.60
Female	6,241	49.40
Age (in years		
(0-11)	2,478	19.61
(12-23)	2,575	20.38
(24-35)	2,507	19.84
(36-47)	2,447	19.36
(48-59)	2,627	20.79
Vaccination status		
Incomplete	540	14.53
Complete	3,260	85.47
Breastfeeding status		
No	5,625	44.52
Yes	7,009	55.48
Residence		
Urban	4,318	34.17
Rural	8,316	65.83
Water source		
Unprotected	7,578	59.98
Protected	5,041	40.02
Toilet facility (shared)		
Not Shared	10,417	82.45
Shared	2,198	17.55
Family income		
Poorest	3,003	23.77
Poorer	3,018	23.89
Middle	2,876	22.77
Richer	2,142	16.96
Richest	1,593	12.61
Mothers' educational level		
No education	1,417	11.22
Primary	7,029	55.64
Secondary	3,740	29.61
Higher	445	3.53
Mothers' age category		
<20	903	7.15
20-24	3,018	23.89
25-29	3,283	25.99
30-34	2,632	20.84
>35	2,796	22.13
Diarrhea		
No	10,604	83.90
Yes, last two weeks	2,030	16.10

4.1.1 Diarrhea prevalence by province

Diarrhea prevalence differed by province. The difference was percentage calculated from the total number of study participants per province against the total prevalence. The figure below shows the prevalence being highest in Copper belt province (20%) followed by Southern (18%), while the lowest prevalence was in Central and Western provinces (13% each).

Figure 2: Showing diarrhea prevalence by Province

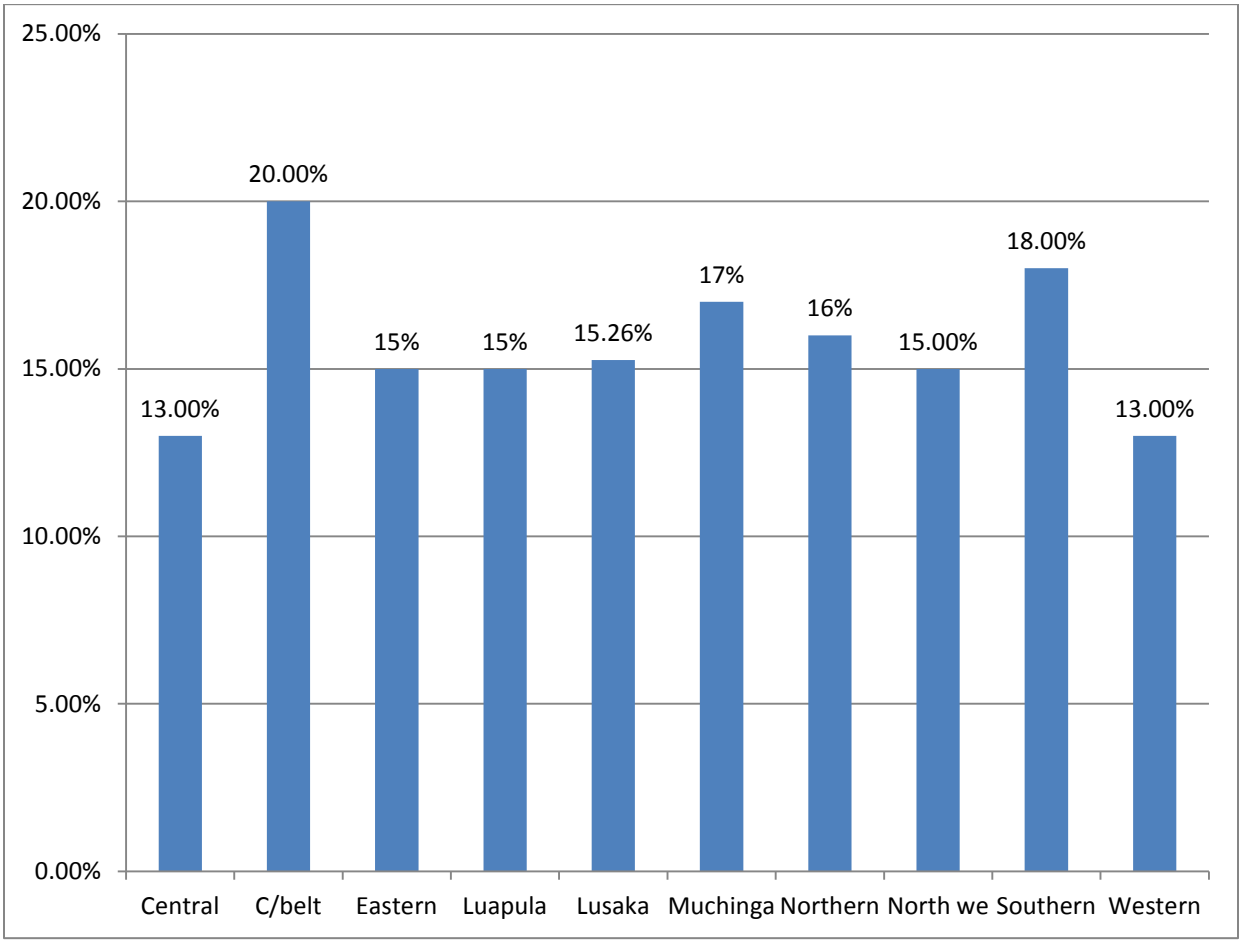


Figure 2: Prevalence of diarrhea among under-five children by provinces of Zambia

4.2 FACTORS ASSOCIATED WITH DIARRHEA AMONG UNDER-FIVE CHILDREN IN ZAMBIA

4.2.1 Association of children's socio-demographic factors and diarrhea

Overall there was an insignificant difference in the prevalence of diarrhea between the male (18.24%) and the female (17.21%).The mean age was two years (not shown). Diarrhea rate was higher among the 12-23month age group 750 (28.77) while the lowest prevalence 261 (9.18%) was among the 48-59 age group. With every one year increase in age, there was a reduction in prevalence of diarrhea among the children. From the analysis, child's age group and breast feeding status were significant at 95% CI, while sex was not (p-0.105).

TABLE 3: Association of children's socio-demographic factors and diarrhea

Variable	**Diarrhea**		
	No n (%)	**Yes n (%)**	**p-value**
Sex			
Male	5,345 (81.76)	1,169 (18.24)	**0.105****
Female	5,255 (82.79)	1,071 (17.21)	
Age group			
(0-11)	2,049 (82.62)	431 (17.37)	
<0.001**			
(12-23)	1,825 (71.22)	750 (28.77)	
(24-35)	2,016 (80.63)	464 (19.36)	
(36-47)	2,128 (86.04)	325 (13.95)	
(48-59)	2,352 (90.82)	261 (9.18)	
Vaccination status			
Incomplete	497 (92.04)	2,680 (82.26)	**<0.001****
Complete	43 (7.96)	578 (17.74)	
Breast feeding status			
No	4,689 (83.36)	936 (16.64)	**<0.001****
Yes	5,705 (81.40)	1,303 (18.60)	

*** Chi-square Test.*

4.2.2 Association of mother's socio-demographics and diarrhea

All the variables (age, income and education attainment) in this category were found to be significant at bi-variate analysis, age (p-value <0.001), income (p-value 0.010) and mother's education attainment (p-value 0.013).

TABLE 4: Association of Mother's socio-demographics and diarrhea

Variable			
		Diarrhea	
	No n (%)	**Yes n (%)**	**P-value**
Family income			
Poorest	2,579 (85.07)	453 (14.93)	
0.010**			
Poorer	2,467 (84.66)	445 (15.34)	
Middle	2,190 (84.14)	413 (15.86)	
Richer	1,776 (80.57)	428 (19.43)	
Richest	1,592 (84.54)	291 (15.46)	
Mothers' education			
No education	1,182 (83.91)	223 (16.09)	
0.013**			
Primary	5,970 (84.25)	1,116 (15.75)	
Secondary	3,060 (82.91)	629 (17.09)	
Higher	392 (85.03)	62 (14.97)	
Mothers' age category			
<20	682 (77.37)	200 (22.63)	**<0.001****
20-24	2,483 (82.20)	537 (17.80)	
25-29	2,750 (83.90)	528 (16.10)	
30-34	2,287 (86.18)	367 (13.82)	
>35	2,402 (70.35)	398 (29.65)	

***Chi-squreTest*

4.2.3 Environmental factors associated with diarrhea

Table five shows environmental factors associated with diarrhea. The table shows that drinking water sources were categorized as protected (i.e. tap water, piped to dwelling water, bottled water, borehole water, protected well, protected spring and tank water) and unprotected (i.e. unprotected well, unprotected spring, rain water and river water). All the three variables (water source, toilet facility and residence) were significant (p-value <0.001).

TABLE 5: Association of environmental factors and diarrhea

Variable	diarrhea		
	No n (%)	**Yes n (%)**	**p-value**
Water source			
Unprotected	6,182 (81.42)	1,411(18.58)	**0.010****
Protected	4,271 (83.91)	819 (15.98)	
Toilet facility			
(shared) No	6,939 (83.86)	1,336 (16.13)	**<0.001****
Yes	3,467 (79.57)	890 (20.43)	
Residence			
Urban	3,972 (79.47)	772 (20.53)	**<0.001****
Rural	6,962 (83.72)	1,258 (16.28)	

***Chi-square Test*

4.3 UNIVARIATE AND MULTIVARIATE ANALYSIS

Table five shows both adjusted and unadjusted logistic regression analysis of the predictors of diarrhea. Children who were aged 12-23 months had an increased (p-<0.01, CI 1.66-2.17, OR 1.90) chance of having diarrhea both at unadjusted and adjusted estimates compared to the other age groups. Females were associated with a decreased (p-0.129, CI 0.85-1.02, OR 0.93) chance of having diarrhea compared to the males. Those who had shared toilet facilities had an increased (p-<0.001, CI 1.17-1.45, OR 1.30) chance of having diarrhea than those who did not share. Breast feeding status was significant at unadjusted analysis but showed to be insignificant after adjusting for the other variables. Vaccination status was significant at both unadjusted and adjusted analysis (p-<0.001, CI 1.80-3.44, OR 2.49).

TABLE 6: Univariate and multivariate analysis

	Univariate			Multivariate		
Variable	**OR**	**95% CI**	**P-value**	**AOR**	**95% CI**	**P-value**
Age (years)						
(0-11)	1			1		
(12-23)	1.90	(1.61-2.28)	<0.001	2.22	(1.50-3.28)	**<0.001**
(24-35)	1.14	(0.95-1.21)	0.155	1.20	(0.81-1.76)	0.355
(36-47)	0.77	(0.64-0.92)	0.005	1.01	(0.69-1.48)	0.945
(48-59)	0.48	(0.39-0.58)	<0.001	0.76	(0.51-1.11)	0.160
Sex						
Male	1			1		
Female	0.93	(0.83, 1.03)	0.203	0.86	(0.69- 1.08)	0.208
Vaccination sts						
Complete	1			1		
Incomplete	2.49	(0.85-1.02)	<0.001	4.73	(2.88-7.71)	**<0.001**
Breast feeding						
No	1			1		
Yes	1.14	(1.01-1.28)	0.023	0.62	(0.36-1.09)	0.103
Mothers age						
<20	1			1		
20-24	0.83	(0.67-1.04)	0.092	0.61	(0.42-0.89)	0.090
25-29	0.67	(0.54-0.83)	0.151	0.55	(0.37-0.82)	0.145
30-34	0.54	(0.43-0.67)	0.841	0.55	(0.36-0.84)	0.372
>35	0.51	(0.37-0.70)	0.041	0.45	(0.27-0.74)	0.316
Income						
Poorest	1			1		
Poorer	1..04	(0.85-1.25)	0.667	0.88	(0.63-1.23)	0.477
Middle	1.09	(0.92-1.29)	0.275	0.86	(0.59-1.25)	0.445
Richer	1.50	(1.24-1.80)	<0.001	1.19	(0.79-1.80)	0.397
Richest	1.10	(0.88-1.39)	0.383	1.01	(0.59-1.73)	0.947
Mother's education	1			1		
No education	1.03	(0.85-1.24)	0.013	0.92	(0.18-0.91)	**0.030**
Primary	1.14	(0.94-1.40)	0.075	0.69	(0.45-1.05)	0.065
Secondary	0.86	(0.60-1.23)	0.094	0.41	(0.64-1.31)	0.085
Higher						
Toilet facility (shared)	1			1		
No	1.33	(1.16-1.52)	<0.001	1.15	(0.90-1.47)	0.251
Yes						
Water source						
Unprotected	1			1		
Protected	0.97	(0.87-1.09)	0.051	1.18	(0.87-1.60)	**0.038**
Residence						
Urban	1		<0.001	1		
Rural	0.77	(0.70-0.85)		0.75	(0.55-1.00)	**0.058**

AOR=Adjusted Odds Ratio OR=Odds Ratio CI=Confidence interval 1=reference group

4.4 PREDICTOR VARIABLES OF DIARRHEA

Table six shows results from multiple logistic regressions. Backward stepwise regression was done. Variables with the largest p-value i.e., the variables that were the least statistically significant (p-values > 0.05) were dropped one at a time, starting with the highest, until the remaining variables had significant values (≤0.05, 95% CI). The results showed that the odds of having diarrhea among the children in the 12-23 month age group were 2.55 times more (p<0.001) than those in the other age groups. Women who were less educated had 1.61 times risk of being associated with diarrhea (p-0.012). The children who resided in rural areas had increased risk of having diarrhea compared to their urban counterparts. Those that had incomplete vaccinations against childhood illnesses (including diarrhea) had 2.18 odds of having diarrhea compared to those vaccinated. Improved water source had decreased chance of association with diarrhea (aOR-0.91, [CI 0.09-0.85], p-0.021).

TABLE 7: Predictor variables of diarrhea among under-five children in Zambia

Variable	AOR	95% CI	P- value
Age of child			
(0-11)	1		
(12-23)	2.55	0.80-0.91	**<0.001**
(24-35)	1.41	0.97-1.97	**0.054**
(36-47)	1.21	0.86-1.72	0.267
(48-59)	0.90	0.64-1.29	0.598
Vaccination status			
Complete	1		
Incomplete	2.18	1.55-3.10	**<0.001**
Residence			
Rural	1		
Urban	0.70	0.59-0.84	**<0.001**
Mothers' education			
No education	1		
Primary	1.61	0.42-0.89	**0.012**
Secondary	0.55	0.37-0.82	0.283
Higher	0.55	0.36-0.84	0.276
Water source			
Unprotected	1		
Protected	0.91	0.09-0.85	**0.021**

AOR-Adjusted Odds Ratio, CI- Confidence interval

CHAPTER FIVE

5.0 DISCUSSION

The study reveals that prevalence of diarrhea in Zambia has remained the same as it was in the 2007 survey at about 16.1%. This could mean that the preventive protocols have not been fully effective or that the Rota virus vaccine against diarrhea may not have had impact yet since its introduction in 2012. The other reason could be that some of the factors that contribute to this illness may not have been understood by the mothers\ care takers. It has been revealed in this study that diarrhea prevalence varies by age group. This study found increased odds of 2.55 times more of having diarrhea among children aged 12-23 months (28.77%) than the younger age group (zero-11 months).

This could be attributed to the fact that at this age the child is introduced to more other foods than breast milk, and this can lead to contamination in preparation of food for the child. It could be related to mothers' knowledge on food preparation and storage. With every one year increase in age there was a decrease in prevalence of diarrhea. The odds of having diarrhea in the older age group 48-59 months, was 0.90 times less than the younger age groups. This could be attributed to the fact that the child's immune system is stronger compared to the younger age group.

A similar study was done in Thailand using secondary analysis of the multiple indicator cluster survey which showed that children aged between 11 months and two years were most likely to develop diarrhea than those in the other age groups, (Wilunda et al, 2006). A study conducted by Teferra et al (2013) in North-western Ethiopia on determinants of diarrhea also reported that diarrhea was prevalent among children aged 12-23 months which is also in line with this study. Rohmawati, 2010 also demonstrated that diarrhea was highest among the 12-23 month age group (19%) compared to the other age groups.

The study also showed difference in prevalence by vaccination status of the child. Those that were not vaccinated against childhood illnesses, were 2.18 times more likely to have diarrhea compared to those that were completely vaccinated (p-value<0.001).

Gupta et al, 2015 conducted a study in west Bengal on factors associated with diarrhea which showed that the prevalence of diarrhea was 21.83% in completely immunized children and 30% in partially immunized children. This result is similar to the one in this study. In Indonesia a study was conducted in 2010 by Nida which showed results that immunization was not associated with diarrhea in children as this could be explained by the fact that the protective effect of measles vaccination against diarrhea is restricted to "with measles diarrhea (one week pre-rash-onset) and "post measles diarrhea" (four weeks post-rash-onset). This study was conducted based on secondary data that was from a DHS report of 2007, which was before introduction of Rota virus vaccine.

On the contrary, findings of a study that was done in Pakistan that showed that children who had measles immunization were less likely to have diarrhea than children who did not have this vaccination (Arif & Ibrahim, 1998).

Prevalence of diarrhea showed no much difference between male and female children (58 % in males and 42% in females). This means that sex was not influential in the prevalence of diarrhea among under-five children in Zambia. A research conducted in India (Syed. M, 2003) revealed that diarrhea was higher in girls compared to boys. A study conducted in Indonesia (Rohmawati, 2010) reported that there was no difference in prevalence between boys and girls. This supports the findings of this study. A study conducted by Zaman (2011) in Pakistan reported that sex was associated with diarrhea. This is different from the findings in this study. Another study that showed different results from our study was the one conducted in Zambia by Irena et al, 2011 which revealed that among the 430 children under study, 238 (55.3%) were males while 44.7% were females. This demonstrated that sex had an influence on prevalence of diarrhea.

Breast feeding was also not significant in determining diarrhea prevalence among the children under-five years in this study. This is consistent with findings in a study by Nida, 2010 in Indonesia which showed no significance between breast feeding and diarrhea. However, Ssenyonga et al (2009) reported a different result from our study that breast feeding was one of the factors associated with diarrhea in under-five children in Uganda. In another study conducted by Gupta et al, diarrhea was noted to be 20.33% in exclusively breastfed children and 31.57% in children who were breastfed for less than 6 months. This showed a positive association between breast feeding and diarrhea.

The study also demonstrated a strong association between residence and diarrhea prevalence. Children who were in the urban areas had 0.7 decreased odds of having diarrhea compared to those in the rural areas ($p<0.001$), even after controlling for other variables. The question that may arise from this is whether the women in the rural areas have enough access to the health promotion messages on the importance of under-five child vaccinations, or whether most of them live far from the health centers. These results are in line with a study by Amal (2011) in Malaysia which observed that those who lived in rural areas and particular ethnic groups were associated with high incidence of diarrhea. Another study that supports the finding of this study was done in Ethiopia by Mengistie et al, 2011 which reported that the odds of having diarrhea were 2.15 times more in rural children than in the urban ones.

Mother's educational level was found to have a strong association with diarrhea. Mothers can understand better the importance of child health if they are exposed to health promotion messages, or if they are of higher education as this was evidenced by the findings of this study which showed that children of mothers with education below secondary level were 1.61 times more likely to have diarrhea compared to those whose mothers had above secondary education. A similar result was observed from a study done by Chilambwe et al (2014) which was done to assess knowledge and attitude at household level. The result showed that those who had knowledge on prevention of diarrhea had lesser cases compared to those who had less or no knowledge at all.

Another study that showed similar results was the one done by Shikur et al, 2013 in southern Ethiopia as a significant number of women did not have adequate knowledge on occurrence and prevention of diarrhea. A study that was conducted by Mihrete et al 2013 also supports the results of this study. The results indicated that low level of maternal education was found to have a strong association with childhood diarrhea after adjusting for other variables. A DHS study in Eritrea showed that mother's higher education level showed a significant negative association with diarrhea, (Woldemicael G. 2001), even after controlling for other variables. Another study in the Philippines, however, suggested that the protective effect of mother's education on childhood diarrhea varies according to the environment where the family lives, as this is more likely in more economically and socially advantaged communities but has no effect in the more

disadvantaged communities (Molina D., 1994). On the other hand, a study by Al-Mazrou et al, 1991 found no significant association between diarrhea and parents' education.

Mother's age was not a significant factor. A study conducted in Egypt also showed mother's age was not a significant factor in the etiology of diarrhea, Sayed et al, 2013. Rohmawati conducted a study that revealed that maternal age groups had no association with diarrhea in children. However, at bi-variate analysis the study found that the prevalence of diarrhea in children with teenage mothers was significantly higher compared to children with older mothers. Another study found that maternal age <20 years increased the risk of diarrhea (Nakawesi et al, 2010). In yet another study by Onyango D.M and Ongienda P.O. 2010, it was reported that diarrhea prevalence was higher in children whose mother's age was below 18 years.

Globally, about 1.1 billion people have no access to improved water sources and 2.4 billion do not have basic sanitation (WHO, 2000). Among the environmental factors this study found that water source was significantly associated with diarrhea (AOR1.19, CI0.09-0.85, p0.021). The children who came from households that had protected water sources had 0.09 less odds of having diarrhea compared to those that had unprotected water sources. This could be so because more than half (59.98%) of the participants had unprotected water sources. This is in line with a study that was conducted by Mengistie and Godana, 2012 in Ethiopia which found that the households that had lack of improved water sources also had a higher percentage of children with diarrhea.

Rohmawati (2010) also found that those in rural areas had higher prevalence of diarrhea compared to those in the urban because water sources and sanitation in the rural were worse than in the urban areas of Indonesia. In north-east Brazil diarrhea was more among the urban poor than the rural poor because climate change affects urban human health particularly in least developed nations where there are changes in water quality and availability, which increase the epidemiology of diarrheal diseases (Siegel, R.R. 1996). The effects of the current and projected climate change will be felt strongly by the urban poor, the elderly and children, subsistence farmers, coastal populations and traditional societies (Dodman, D. 2009).

Toilet facility was not significantly associated with the prevalence of diarrhea among the under-five children at multivariate analysis. This could be linked to the fact that most households

(82.45%) did not share toilets. However, univariate and bi-variate analyses showed significant association between toilet ownership and diarrhea (p-<0.001), while multivariate analysis showed no significance (p-0.251). A study that was done in Misisi compound in Lusaka, Zambia reported association between childhood diarrhea and poor water and sanitary conditions (Oyat, 2007:p.60). Another study was done by Brooks et al, 2003 in Kenya which reported that there was increased risk of diarrhea in households that shared toilet facilities and those that got drinking water from Lake Victoria. This can be supported by a study that was done by Woldemicael 2001, in Eritrea which showed that availability of unshared toilet facility in households was associated with a 27% risk reduction of diarrhea. These studies support results of our study at univariate and bi-variate analyses.

Income was significant only at chi-square test (p-value 0.010). However, it was not significant at univariate as well as multivariate analyses. The different wealth indices indicated an almost even prevalence of cases among them. Only those in the richest wealth index had the lowest prevalence of 291 (15.46%). This is supported by a study that was done by Clarke 2014, in Gambia which showed results that low income countries have low levels of protection against rotavirus diarrhea while a lot of children in these countries are affected.

5.1 LIMITATIONS

- Since this was based on secondary data, some variables mentioned in literature like religious beliefs, cultural beliefs, community norms and ethnicity were not captured.
- The other limitation is that other conditions that are underlying causes of diarrhea like measles are not part of the analysis.
- From the data set it was shown that some of the responses concerning diarrhea prevalence were that the responders did not know whether the child diarrhea or not, so this could lead to information bias.
- Severity and duration of the outcome variable (diarrhea) was not captured in the survey.

CHAPTER SIX

6.0 RECOMMENDATIONS AND CONCLUSION

6.1 RECOMMENDATIONS

1. From the findings in this study, it is recommended that women should be encouraged to take their children for vaccination as scheduled.

2. Policy makers should ensure that health promotion messages reach all masses especially those in the rural areas, by increasing frequency of health promotion messages through community health workers by doing house to house visits. It was shown in the study that most of the children affected by the disease were those in the rural areas.

3. The long term solution for reducing the morbidity from diarrhea might involve the provision of better sanitation and effective educational programs that emphasize hygiene should be strengthened in combination with

4. Women should be encouraged to get formal education beyond primary and secondary level; this helps in understanding important issues including health matters, in this case which could help in reducing and preventing childhood diseases like diarrhea.

5. Severity and duration of diarrhea should be included in the questionnaire.

6. Similar studies on factors associated with diarrhea among under-five children should be conducted in future in order to facilitate continuity and effective implementation of child health intervention programs for policy formulation and the general assessment of resource requirements and intervention prioritization.

6.2 CONCLUSION

This study has identified some important determinants of diarrhea among children under the age of five which include demographic factors, maternal factors as well as environmental factors. A higher risk was observed among the children aged between 12-23 months. The factors associated with diarrhea among under-five children were found to be child's age, vaccination status,

mothers' education level, water source and residence. Although there are prevention and treatment guideline protocols, there is still a problem in the prevalence of diarrhea in Zambia among the under-five children.

Findings from this study have shown that women need to be encouraged to get formal education to help them understand the importance of health promotion and disease prevention, as well as importance of child immunizations. Similar studies on factors associated with diarrhea among under-five children should be conducted in future in order to facilitate continuity and effective implementation of child health programs, for policy formulation and the general assessment of resource requirements and intervention prioritization.

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