

REGIONAL INSTITUTE FOR POPULATION STUDIES

**HOUSING CONDITIONS AND THE INCIDENCE OF DIARRHOEA AMONG
CHILDREN UNDER 5 YEARS IN GHANA**

BY

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**THIS DISSERTATION IS SUBMITTED TO THE UNIVERSITY OF GHANA,
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DECLARATION

I, Patrick Addo, declare that this research work on the topic “Housing Conditions and the Incidence of Diarrhoea among Children Under 5 Years in Ghana” is the result of my original work produced under the supervision of Dr. Pearl Kyei. All ideas and information from other people’s work which are used in this project work have been duly acknowledged and cited.

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ABSTRACT

Globally, diarrhoea infection among children under five years has declined in the past three decades, yet it is still prevalent in developing countries. Almost two-thirds (63%) of diarrhoea incidence among children under 5 occurs in developing countries. Despite improvements made in adequate water provision and sanitation, diarrhoea remains endemic in Ghana, particularly among children under five years. The determinants of diarrhoea are inconclusive and inconsistent specifically with regards to how material made of housing structures can predispose children under five years to diarrhoea. This study therefore aims to contribute to knowledge by assessing the housing conditions and the incidence of diarrhoea among children under five years old in Ghana.

This study examined the Ghana Multiple Indicator Cluster Survey (MICS) 2017-2018. The survey sample was then selected using a multi-stage, stratified cluster sampling approach. The study included 8,241 children under five in Ghana. The factors linked to diarrhoea were evaluated using multivariable logistic regression.

The prevalence of diarrhoea was 17.1%. In the binary logistic regression model, place for cooking, presence of fixed facility in dwelling for handwashing, the age of a child, maternal education, household wealth quintile, and place of residence were statistically significantly associated with the incidence of diarrhoea among children under five years in Ghana. The study did not find any significant association between source of drinking water, sanitation, housing material and diarrhoea incidence among children under five years in Ghana.

The prevalence of diarrhoea remains high among children under five years in Ghana. Place for cooking in household is a strong predictor of diarrhoea infection. This study recommends education should be given to mothers/caregivers to keep their place of cooking safe and clean.

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CHAPTER ONE

1.0 INTRODUCTION

1.1 BACKGROUND TO THE STUDY

Enabling children to reach their full potential is a human right that is critical for long-term development (World Health Organization [WHO], 2020). Over the last two decades, there has been a significant improvement in child health, survival, and nutrition. (Karambizi et al., 2021; Kyu et al., 2013). This progress has been associated with the delivery of effective, successful, and productive behavioural, biomedical and environmental interventions (National Research Council and Institute of Medicine, 2004; Victora et al., 2022). However, there is a significant distinction between developed and developing nations. (Victora et al., 2022). Several children and adolescents in resource-poor settings are not able to reach full optimal health (Kruk et al., 2022). This is mainly due to poor health systems, and inadequate access to healthcare and social systems (Kruk et al., 2022).

Diarrhoea could be defined as when an individual has three or more watery stools than usual in a day (WHO, 2017). Globally, the incidence of diarrhoea infection in children below five years has declined in the past three decades, yet it is still prevalent among children in developing countries (Behera & Mishra, 2022). Diarrhoea remains one of the leading causes of sickness and mortality in children below five years living in low resource environments (Das et al., 2014; Das & Bhutta, 2016). Childhood diarrhoea makes a significant contribution to disability-adjusted life years (DALYs) associated diseases (Behera & Mishra, 2022; Karambizi et al., 2021). It contributes to early childhood mortality after the neonatal stage more than any other disease (Kyu et al., 2013; Troeger et al., 2018). The World Health Organization (WHO) estimates that 1.7 billion cases of

paediatric diarrhoeal illnesses are reported each year, and that they result in half a million (525,000) fatalities among children yearly (2017). In underdeveloped countries, children under 5 make up almost two-thirds (63%) of the diarrhoea incidence (Ugboko et al., 2020).

Albeit the decline in diarrhoea cases globally, it is still prevalent amidst children under five years of age in Africa (Black et al., 2019). Over 50% of diarrhoea cases are concentrated in Africa and South Asia (Behera & Mishra 2022). The burden of the disease varies across the sub-region (Mihrete et al., 2014; Moon et al., 2019; Shine et al., 2020; Tambe et al., 2015). Several studies report a high prevalence of the disease among children in the region (Apanga & Kumbeni, 2021; Ndikubwimana, 2020; Nguyen et al., 2021). Cross sectional studies conducted in Benna Tsema district, Ethiopia and Mathare informal settlement to determine the prevalence of diarrhoea among children below age five showed a total prevalence of 23.3% and 18.7% respectively (Alemayehu et al., 2020; Guillaume et al., 2020). Moreover, a cross-sectional study in Cape Town, South Africa also indicated a high (15.3%) prevailing of diarrhoea in children below age five. However, children living in informal settlements had a lower prevalence (13.4%) as compared to children living in formal settlements (21.2%) (Nguyen et al., 2021). In Jordan Valley, the total prevalence of child diarrhoea was 21.3%. Housing conditions variables that were shown to be related were adequacy of septic tanks, availability of tap water, adequate supply of drinking water, extended versus nuclear family, income, family size, toilet, kitchen cleanliness, and crowding index (Okour et al., 2012).

Diarrhoea remains endemic in Ghana, particularly among children (Anyorikye et al., 2016; Apanga & Kumbeni, 2021). It is one of the uppermost reasons of children's hospitalization and death (Tetteh et al., 2018). More than 9 million cases of child diarrhoea are reported annually (Afitiri et al., 2020; Tetteh et al., 2018). An examination of the 2017/2018 Ghana Multiple Indicator Cluster Survey (MICS) among 8879 children aged below five years showed a 17% prevalence of

diarrhoea among them (Apanga & Kumbeni, 2021; Ghana Statistical Service (GSS), 2018). This preventable disease kills approximately 14,000 children before age five annually (Asamoah et al., 2016; Binka et al., 2011), contributing to one-fourth (25%) of all childhood mortalities in Ghana (Binka et al., 2011).

Diarrhoea is caused by several environmental and behavioural factors (Adjei et al., 2004; Krumkamp et al., 2015; Workie et al., 2019), lack of toilet facility, inappropriate disposal of child stool (Ahmed et al., 2018; Binka et al., 2011). Low maternal education levels and having more than two children ever born are factors that increase the risk of child diarrhoea (Das et al., 2014; Das & Bhutta, 2016; WHO, 2020). In addition, children of uneducated mothers are more susceptible to diarrhoea than their counterparts, especially when there are no toilet facilities available at home (Apanga & Kumbeni, 2021; Danquah, 2015; Mølbak et al., 1997). Lack or inadequate access to water, sanitation, hygiene, undernutrition, poverty, education, poor feeding practices, overcrowding, and deprived household conditions contribute to the vulnerability of children to succumb to diarrhoea (Larbi et al., 2021; Songsore, 2008; Songsore & Mcgranahan, 1993). Moreover, rising population growth and increasing movement to urban cities have led to the development of many informal settlements that present several health threats (Larbi et al., 2021; Nguyen et al., 2021). These exposure factors are prevalent in deprived settings, compounded by the unequal distribution of global healthcare resources, which renders children in these environments more susceptible to experiencing episodes of diarrhoea (Ameyaw et al., 2017; Larbi et al., 2021).

Traditionally, housing conditions have strongly been linked to health outcomes (Tuthill, 2003). Diseases like the plague, typhoid fever, and diarrhoea broke out in the 18th century as a result of unsanitary housing, low accessibility to clean water, poor sanitation, and improper waste disposal

(British Columbia Medical Journal, 2020). Children residing in households without access to a toilet facility, where faeces are present around the compound, and with pit holes and thatched or leaking roofs (Ameyaw et al., 2017; Workie et al., 2019), are more prone to diarrhoea. In comparison, children living in households with secured or corrugated iron roofs, safe water facilities, proper handwashing practices, and effective waste management exhibit lower susceptibility to diarrhoea (Getachew et al., 2018; Ndikubwimana, 2020).

The most prevalent types of dwelling units in Ghana are separate houses (detached) 63.3% and compound houses 20.9% (Ghana Statistical Service (GSS), 2021). Separate house (detached) is however more predominant in rural 76.6% than urban 53.8% areas (GSS, 2021). Compound house as described by (Asante & Ehwi, 2020) is a housing type in which inhabitants share basic facilities such as toilet facilities, kitchens, and electric meters. Though some researchers have documented shared toilet and sanitary facilities as unhygienic and unsafe because it does not prevent human contact and human faeces hence, encouraging the transmission of diarrhoea diseases, the situation still exists in a significant number of dwelling units in Ghana. These houses are characterized by obsolete, open or partially covered pit latrines, insufficient waste management and sanitation facilities, limited access to electricity and drinkable water, inadequate health and educational services, and inferior housing, especially in Ghana's rural villages (Adjei & Kyei, 2013).

Children spend a significant amount of their time within the house (Harker, 2007). Physical housing and neighbourhood conditions predispose them to a high risk of injury and environmental toxins such as lead, mould, and dampness (World Health Organization (WHO), 2011). Children living in substandard houses experience ill health (Padgett, 2020; Unger, 2013). Poor housing conditions, such as insufficient access to water, sanitation, and hygiene, are linked to poor health outcomes (Chatindiara et al., 2022; Tustingi et al., 2020a). There is ample evidence on housing

conditions (like inadequate access to water, poor waste management, and sanitation facilities) and diarrhoea incidence among children, nonetheless, other variables like dwelling floor material, roof material, and exterior wall material have been shown to influence diarrhoea outcomes among children is less researched. This study examines the impact of housing conditions in Ghana, such as the type of material used to construct homes, on diarrhoea outcomes in young children. The study thus explores the relationship between housing conditions and the incidence of diarrhoea in children below five years in Ghana.

1.2 STATEMENT OF THE PROBLEM

Children under age five in underdeveloped countries still experience diarrhoea as one of the main causes of illness and mortality (Florez et al., 2020; Karambizi et al., 2021; Manetu et al., 2021). Every year, 1.7 billion diarrhoea episodes occur in children below five years around the world. (Shine et al., 2020; WHO, 2020). Children under the age of three (3) years have three or more episodes of diarrhoea per year (Alemayehu et al., 2020) causing one in five children's deaths (Manetu et al., 2021). Diarrhoea accounts for more than half a million (525,000) deaths in children below the age of five years annually (Troeger et al., 2018). South Asian and SSA countries contribute to an estimated 88% of all diarrhoea illnesses and deaths due to inadequate access to safe and improved drinking water, sanitation, and hygiene (Manetu et al., 2021).

Diarrhoea poses a greater public health threat in Ghana, and it is one of the leading causes of child hospitalization (Apanga & Kumbeni, 2021) and mortality (Afitiri et al., 2020; Tetteh et al., 2018). Children under 5 years are heavily burdened (Florez et al., 2020). It ranks among the top five national factors contributing to morbidity and mortality in children under five (Afrifa-Anane et al., 2022). In the year 2011, more than 113,786 children under five years diarrhoea cases were recorded in Ghana with 354 deaths in that same year, and 2,318 of those individuals apparently had severe

dehydration (Binka et al., 2011). Again, diarrhoea kills more than 14, 000 children under five years every year (Ameyaw et al., 2017). A facility-based trend analysis study of 17,740 children in Jasikan, Ghana, revealed a soaring widespread of diarrhoea in children under five, especially in girls (Tetteh et al., 2018). Children aged 12-24 months have greater probabilities of suffering from diarrhoea than children aged below 12 months. This was because children aged 12-24 months are introduced to complementary foods which could be contaminated with faecal matter, water and prepared in an unclean environment (Amugsi et al., 2015).

Diarrhoea has both immediate and long-term consequences for children, their families, and the country. For young children under five, it is a significant contributor to malnutrition, dehydration, and even death (Gebru et al., 2014). Furthermore, diarrhoea impairs physical and cognitive functioning in children under the age of five. Diarrhoea has an indirect cost because it causes women to miss work and spend days in hospitals providing for ill children (Aikins et al., 2010). In addition, the family's earnings are spent on drugs, lodging, and movement to and from the hospital (Aikins et al., 2010; Kumi-Kyereme & Amo-Adjei, 2016). The government has a significant cost burden in dealing with diarrhoea infections. An estimated US\$33 million is spent each year in Ghana on the direct and indirect expenses of diarrhoeal illnesses (Aikins et al., 2010).

According to earlier studies, children under the age of five in Ghana reported a prevalence of more than 19% burden of diarrhoea (Onda et al., 2012). About two decades ago, a household survey that randomly selected 489 children below six years in the Accra Metropolitan Area reported 19.2% diarrhoea in the two weeks preceding the study. Diarrhoea caused by dysentery was found to be 29.8% and a negative correlation was observed between the incidence of childhood diarrhoea and household economic status and the mother's education (Boadi & Kuitunen, 2005). Adjei et al. (2004) also reported 27.8% prevalence of childhood diarrhoea among children at the Korle-Bu

Teaching Hospital in Accra, Ghana. *Cryptosporidium* was found to be the commonest cause of diarrhoea among children aged 6-24 months but was exclusive in children aged below 6 months.

Ghana has made significant strides in providing basic water services at the national level. However, just 36% of individuals use an improved source of water, and only 18% have access to at least minimal sanitization (United Nations Ghana, 2023). This puts 76% of families at threat of drinking water that is potentially polluted with faeces (United Nations Ghana, 2023). The increasing population presents a significant challenge in terms of maintaining and managing existing infrastructure. Additionally, the reduction of wetlands further exacerbates water scarcity, accelerates urbanization, and places additional strain on the availability of safe drinking water and sanitation in urban areas (United Nations Ghana, 2023).

Several studies attribute the prevalence of childhood diarrhoea in Ghana to environmental and behavioural factors (Apanga & Kumbeni, 2021; Boadi & Kuitunen, 2005). The majority of these studies have found that the job and education of a mother, kind of toilet, place of abode, living conditions, poverty, handwashing, presence of human faeces in the household compound, and overcrowding all play a role (Bitew et al., 2017; Mihrete et al., 2014), children who live in households with poor personal and domestic hygiene conditions such as improper child stool disposal methods, inadequate water supply, and water quality are factors that influence child diarrhoea (Anyorikeya et al., 2016; Tampa-Naah et al., 2019; Tetteh et al., 2018).

A substantial number of studies that have examined housing conditions and diarrhoea incidence in Ghana have predominantly employed a cross-sectional study design with a focus on a selected district in the country (Anyorikeya et al., 2016; Krumkamp et al., 2015; Tackie-ofosu et al., 2014). These sampled children used in the studies cannot be said to be a representation of all children less than five years in Ghana. The only study, to the best of my knowledge that used a nationally

representative survey, which could be said to be a good representation however did not investigate the association between housing conditions such as the primary outside wall material, the major roof material, and the main exterior floor material, and how these can cause a child to get diarrhoea (Apanga & Kumbeni, 2021). This study considered conditions such as toilet facility, sanitation, source of drinking water, water treatment, waste disposal, and the building material like the main material used for dwelling floor, roofing, and the main exterior wall of the building and how these can risk a child to diarrhoea.

Even though several studies on the African continent have found a link between material made of housing structure (floor, roof and main exterior wall) and the risk of child diarrhoea, the findings have been inconclusive (Mihrete et al., 2014). Additionally, the extent to which the material of which the structure is made can potentially predispose children under five years to diarrhoea is poorly understood particularly in the context of Ghana. This indicates a need to understand the various factors of diarrhoea that exist. Therefore, this study seeks to examine the relationship between characteristics of housing structures and the risk of incidence of diarrhoea among children under five years in Ghana.

1.3 RESEARCH QUESTIONS

The study seeks to answer the following intended questions:

1. What is the prevalence of diarrhoea among children under the age of five in Ghana?
2. What housing conditions are associated with the likelihood of a child before age five to experience episodes of diarrhoea in Ghana?
3. What factors predict the occurrence of diarrhoea in children under the age of five in Ghana?

1.4 STUDY OBJECTIVES

1.4.1 GENERAL OBJECTIVE

The study's overarching goal was to investigate the relationship between housing conditions and the incidence of diarrhoea among children under five years in Ghana.

1.4.2 SPECIFIC OBJECTIVES

the specific objectives of the study are to:

1. Ascertain the prevalence of diarrhoea in children under five years in Ghana.
2. Examine the housing conditions associated with the risk of incidence of diarrhoea among children under five years in Ghana.
3. Discuss predictors of diarrhoea incidence among children under five years in Ghana.

1.5 RATIONALE

Providing and improving maternal and child health is central to global public health objectives and priorities. The effort to improve child health has progressed beyond the Millennium Development Goals (MDGs) to now include Sustainable Development Goals (SDGs). Despite this, diarrhoea continues to be a major factor in hospital admissions and fatalities in Ghana, particularly among children age less than five years. This poses a greater threat to public health. Housing conditions (such as insufficient access to water, poor sanitation, poor hygiene, the presence of faeces in the compound, and so on) have been found to significantly contribute to diarrhoea, respiratory, communicable, and noncommunicable diseases, and injuries. Identifying and implementing effective and sustainable solutions to prevent diarrhoea, a potentially fatal infectious disease, is critical to meeting SDG three and improving child survival by 2030.

Again, the justification for conducting this study is rooted in the profound and persistent health challenges faced by children under the age of five in underdeveloped countries, particularly concerning the prevalence of diarrhoea. Despite advancements in healthcare and development, diarrhoea remains a major contributor to illness and death among young children (Florez et al., 2020; Karambizi et al., 2021; Manetu et al., 2021). The alarming global statistic of 1.7 billion annual diarrhoea episodes in children below the age of five underscores the urgency of addressing this issue (Shine et al., 2020; WHO, 2020). Moreover, the fact that one in five child deaths is attributed to diarrhoea, along with over half a million annual deaths in children under five, highlights the immediate need for effective interventions (Manetu et al., 2021; Troeger et al., 2018).

Within this context, the situation is particularly dire in Ghana, where diarrhoea poses a significant public health threat, ranking among the leading causes of child hospitalization and mortality (Apanga & Kumbeni, 2021; Afitiri et al., 2020; Tetteh et al., 2018). The substantial burden faced by children under five years of age is evident, with significant morbidity and mortality consequences (Florez et al., 2020; Afrifa-Anane et al., 2022). The prevalence of diarrhoea in Ghana, as indicated by historical records, remains concerning, necessitating a deeper understanding of the contributing factors (Boadi & Kuitunen, 2005; Adjei et al., 2004).

Furthermore, the broader implications of diarrhoea extend beyond immediate health consequences, affecting nutrition, cognitive development, economic productivity, and national healthcare costs (Gebbru et al., 2014; Aikins et al., 2010; Kumi-Kyereme & Amo-Adjei, 2016). Given the multifaceted impact on families, communities, and the government, addressing diarrhoea is crucial not only for improving child health but also for promoting socio-economic development.

However, despite the recognition of environmental and behavioural factors contributing to diarrhoea prevalence in Ghana, the specific influence of housing structure characteristics remains less understood (Apanga & Kumbeni, 2021; Mihrete et al., 2014). Prior studies have yielded inconclusive results, emphasizing the need for a focused investigation in the Ghanaian context (Mihrete et al., 2014). This study aims to bridge this knowledge gap by examining the relationship between housing structure attributes and the risk of diarrhoea incidence among children under five years. As housing structure is a tangible and modifiable factor, understanding its role in diarrhoea incidence can provide actionable insights for targeted interventions and policy formulation.

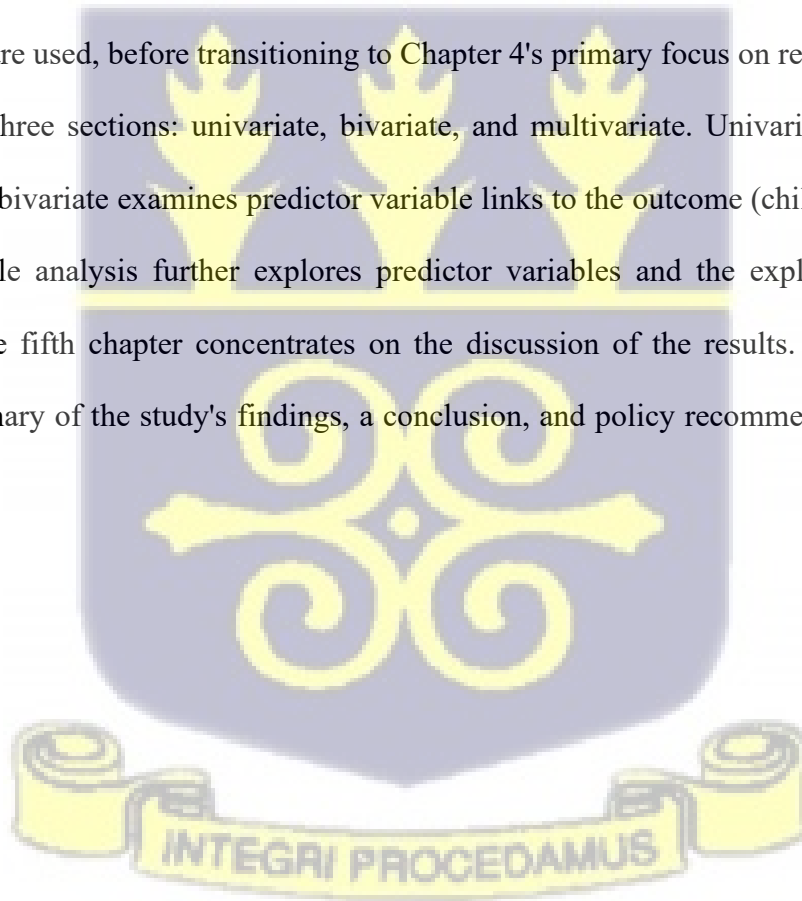
This study examined the relationship between housing conditions (specifically, the roofing, floor and main exterior wall material of the housing structure) and the incidence of childhood diarrhoea in Ghana. Furthermore, this study will add to a small but growing body of literature indicating a significant association between housing material and diarrhoea incidence in children under the age of five (Bitew et al., 2017; Ndikubwimana, 2020).

Though previous studies report poor hygiene and sanitation as the major causes of diarrhoea, now, a growing but small body of literature indicates an association between building materials such as (materials used for dwelling floor, roof material, and main exterior wall material) and diarrhoea incidence among children (Getachew et al., 2018; Ndikubwimana, 2020; Tustingi et al., 2020b; Yaya et al., 2018). Identifying the conditions within the household and the characteristics of the housing unit and understanding how these conditions could predispose children to diarrhoea incidence is relevant. Additionally, this will help mothers/caretakers to put in place measures that will improve child health and child survival to prevent early childhood morbidity and mortality. It is therefore important for more research to be conducted to better understand the mechanisms

through which the disease-causative organisms of diarrhoea operate. This will help to put effective measures and targeted interventions to prevent diarrhoea incidence among children.

1.6 ORGANIZATION OF THE STUDY

There are six chapters in the study. The study's background, problem statement, research questions, study objectives, and justification are all included in the first chapter. The second chapter examined pertinent literature in the subject area. Additionally, the conceptual framework, theoretical framework and hypotheses are also discussed. The third chapter outlines the study's methodology, covering data source, study design, sampling of the study population, and the conceptualization, operationalization, and measurement of variables. The chapter also details the analysis process, statistical software used, before transitioning to Chapter 4's primary focus on results. This chapter is divided into three sections: univariate, bivariate, and multivariate. Univariate outlines study variables, while bivariate examines predictor variable links to the outcome (childhood diarrhoea). The multivariable analysis further explores predictor variables and the explanatory variable's relationship. The fifth chapter concentrates on the discussion of the results. The final chapter includes a summary of the study's findings, a conclusion, and policy recommendations based on the findings.



CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 INTRODUCTION

This chapter reviews the literature and describes the study's theoretical framework. The literature is reviewed according to the study objectives, as well as the variables suggested in previous studies to influence the incidence of diarrhoea in children less than five years. The final section includes a brief description of the conceptual framework developed to understand the interaction between the selected variables necessary to affect the child's health (diarrhoea).

2.2 DEFINITION OF DIARRHOEA

Diarrhoea is defined as having three or more loose, watery stools per day (WHO, 2020). It is a sign of an intestinal infection brought about by many bacterial, viral, and parasite species, most of which are conveyed by water contaminated with faeces (Yaya et al., 2018). Diarrhoeal infections are more common when there is a lack of proper sanitation, hygiene, and safe water for drinking, cooking, and cleaning (Moon et al., 2019). Diarrhoea that normally lasts (1-2) days and resolves by itself. There are three types of diarrhoeas, Acute diarrhoea is a common form of diarrhoea that normally lasts one to two days before disappearing on its own. In most cases, persistent diarrhoea lasts for four weeks or longer (Podewils et al., 2004). And the third; is chronic diarrhoea. This kind of diarrhoea lasts for at least 4 weeks.

Rotavirus and *Escherichia coli* are the two most common etiological agents of moderate-to-severe diarrhoea in low-income countries (Weldegebriel et al., 2018). Other pathogens, such as *Cryptosporidium* and *Shigella*, may also play a role (Carmo et al., 2011; Lamberti et al., 2016).

The causative organisms of diarrhoea can be transmitted in various ways. The bacteria which is more prevalent in developing countries are commonly spread through faecal-oral (Workie et al., 2019). This is largely due to poor hygienic and sanitation conditions which are believed to be the mode of transmission (Behera & Mishra, 2022; Guillaume et al., 2020). Viral pathogens are also transmitted through contaminated food and drinking water that has come into contact with faecal-oral matter and subsequently ingested. Nonetheless, other routes such as fomites and respiratory secretions could also be other alternatives routes through which they can be transmitted.

The most important risk factors for diarrhoea in children are (age, birth weight), mother's characteristics such as (education, occupation, poverty, and handwashing), household's characteristics like (the type of toilet, the location, living conditions, the presence of human waste in the home compound, the quality of the housing material, and crowding) (Bitew et al., 2017; Mihrete et al., 2014). Children who live in households with poor personal and domestic hygiene conditions such as improper disposal methods of child stool, inadequate water supply, and poor water quality are at an increased risk of diarrhoea (Anyorikeya et al., 2016; Tampah-Naah et al., 2019; Tetteh et al., 2018). Furthermore, rural children, children whose mothers had a 24 month or longer interval between births, and those houses' floors made of dung and mud materials are more likely to have diarrhoea episodes, whereas children from wealthy households, children with well-educated mothers, are less likely to suffer diarrhoea morbidity and mortality (Larbi et al., 2021; Songsore, 2008).

2.3 PREDICTORS OF CHILDHOOD DIARRHOEA

The existing literature has identified several factors responsible for diarrhoea infection among children below the age of five years (Kassebaum et al., 2019; Ullah et al., 2019). These studies report behavioural, socioeconomic, and environmental factors as the main contributors to child

diarrhoea (Shine et al., 2020). The behavioural factors that influence child diarrhoea include poor hand hygiene, waste disposal, child breastfeeding, feeding with a bottle, and rotavirus vaccination of the child (Boadi & Kuitunen, 2005; Danquah, 2015). The availability of water, toilet facilities, presences of faeces in household compounds and housing conditions are all environmental factors that contribute to the incidence of diarrhoea in children under the age of five (Alemayehu et al., 2020; Woldemicael, 2001). The socioeconomic factors which influence diarrhoea among children are mothers/primary caretaker's educational level, income, place of residence (Asfaha et al., 2018). Sociodemographic characteristics such as maternal and child age also determine the occurrence of diarrhoea disease (Mohammed & Tamiru, 2014).

2.3.1 HOUSING CONDITIONS AND THE INCIDENCE OF DIARRHOEA INFECTION AMONG CHILDREN UNDER FIVE YEARS

Substantial literature on child diarrhoea infection has focused on environmental factors that contribute to diarrhoea infection in children under the age of five (Mohammed & Zungu, 2015; Paul, 2020). These studies suggest that a variety of environmental factors, including the source of children's food and drinking water, the availability of restrooms, sanitary conditions, inappropriate waste disposal, informal settlements, and many others, have an impact on children's diarrhoea (Ishimwe et al., 2020; Workie et al., 2019). In India, a cross-sectional study by Paul (2020), in which he analysed secondary data from the National Family Health Survey involving 247,743 children under the age of 5, revealed concerning environmental conditions like child stool disposal, floor materials, and roof materials of the housing units were found to be significant predictors of the occurrence of childhood diarrhoea.

2.3.2 SOURCE OF DRINKING WATER

Access to safe, protected and dependable drinking water is known to protect children under the age of five from childhood diarrhoea. Prior studies have shown that children without protected and safe drinking water source have higher odds of contracting diarrhoea as compared to children with safe and protected drinking water source (Workie, 2019; Moon et al. 2019). These findings have been corroborated by several studies (McClelland et al., 2022; Mshida et al., 2017). Children who have access to improved water sources, such as pipes or taps, are less likely to get diarrhoea than children who do not (river, stream) (Agegnehu et al., 2019). In low- and middle-income countries (LMICs), a systematic review and meta-analysis study indicated that providing an improved drinking water supply on premises with greater water quality reduced the risk of diarrhoea by (52%), compared to an unimproved source. (Wolf et al., 2022).

The impact of the source of drinking water on the frequency of diarrhoea in children has also been highlighted by numerous other studies (Masangwi et al., 2009; Plate et al., 2004). These studies indicated the odds of diarrhoea are higher for children with access to unimproved water sources (McClelland et al., 2022). For instance, a community-based cross-sectional study revealed that children whose drinking water sources were unprotected had a 2.68 times higher risk of diarrhoea than those whose sources were protected (Workie et al., 2019). Similar to this, research by (Bitew et al., (2017) and Larbi et al., (2021) demonstrated a statistical association between childhood diarrhoea diseases and an unprotected source of drinking water. Additionally, a systematic analysis revealed that implementing WASH interventions aimed at improving water quality directly where it is used demonstrated a notable 40% reduction in the likelihood of experiencing diarrhoea and 27% for encouraging handwashing with soap under running water. This reduction was specifically observed in relation to water filtration, showing a 31% decrease in risk, and in the context of water

disinfection (Darvesh et al., 2017). Okour et al., (2012) also showed tap water availability, drinking water quantity, and frequency of water reservoir cleaning were also found to be significantly associated with a reduction in childhood diarrhoea.

Nonetheless, a handful of studies report no association between access to improved water sources and a child's chances of developing diarrhoea (Cronin et al., 2016). They argue that other behavioural factors such as handwashing practices could be the cause of diarrhoea in children (Begum et al., 2011). Furthermore, a case-control study conducted in Northeast Brazil showed that socioeconomic factors such as (wealth, access to improved sanitation and water, living condition, nutrition) contributed most to determining diarrhoea occurrence more than the source of drinking water (Genser et al., 2008). Similarly, Bennion et al. (2021) did not find a relationship between child diarrhoea and environmental factors, such as access to a water source. They also advocated for more research to better understand the environment in terms of distance to water sources and frequency of use in relation to diarrheal outcomes in Tanzanian children under the age of five. While the literature presents varying findings, it is clear that providing access to clean drinking water reduces the risk of diarrhoea in children under the age of five, particularly in regions where such resources (safe and clean water) are lacking. In order to effectively prevent diarrhoea and decrease the associated risks to children's health and well-being, it is imperative that safe drinking water becomes universally accessible to all.

2.3.3 HOUSING SANITARY CONDITIONS

Sanitation improvements minimize the propagation of bacteria that cause diarrhoea by preventing human faeces from contaminating the environment. In reviewed research, an estimated median reduction in the incidence of diarrhoea has been linked to improved sanitation facilities. Inadequate/lack of access to sanitation facilities coax the spread of solid and liquid waste within

place of abode playing a part in diarrhoea disease transmission especially among children under five years (Manetu & Karanja, 2021). Diarrhoea diseases are related to household sanitation (Beyene & Melku, 2018). Previous studies have established improved sanitation (presence of latrine with slab) is linked to decrease incidence of diarrhoea among children whereas unimproved sanitation is associated with increase odds for diarrhoea particularly in children (Gyimah, 2003).

Lack of toilet facilities in homes is associated with a higher incidence of child diarrhoea than toilet facilities that do not isolate human excreta from human contact (Workie et al., 2019). Children living in households without toilets had a six-fold increased risk of developing diarrhoea compared to children living in houses with toilets (Mihrete et al., 2014). Furthermore, children living in households with presence of faeces on toilet facilities and in the compound have an increased risk of diarrhoea (Natnael et al., 2021). Tambe et al., (2015) found significance association between a child's toilet facilities and diarrhoea. The Children who used the main toilet and other forms of place for convenience, such as the bush, diaper and streams were less likely to suffer from diarrhoea. Furthermore, children who use a flush toilet in the home had a 17% lower risk of contracting diarrhoea than those who defecate in the open (Yaya et al., 2018).

2.3.4 HOUSING MATERIAL (MAIN FLOOR, ROOF, AND EXTERIOR WALL MATERIALS)

A large number of published scientific studies that have established the relationship between housing and health (Clair & Hughes, 2019; Palacios et al., 2021; Spengler et al., 2004). Poor conditions in housing units are known to affect the health of occupants both positively and negatively (Kan et al., 2022). Building materials, poor ventilation, weak structures, overcrowding, poor indoor air quality, damp houses, lead poisoning, noise pollution, and many others have all

been linked to lower respiratory tract infections (LRTI), mental health diseases, and chronic diseases (Diaz & Siegel, 2018; Jensen et al., 2019; Spengler et al., 2004; Tang et al., 2022).

In SSA, housing and health are major public health concerns. A cross-sectional survey among 824,694 children in 33 countries showed an association between poor housing and child health such as, malaria, diarrhoea, acute respiratory infections (Tusting et al., 2020b). A multi-level analysis of the relationship between the functional and sanitary state of housing infrastructure and caregiver reports of common childhood illnesses revealed a strong association between reported respiratory infections, skin infections, and housing condition. The results of the multivariate analysis revealed a robust independent link between the occurrence of respiratory infections and the overall functional state of the household. However, no significant correlation was found between the prevalence of other illnesses and either the overall functional state of the residence or the functionality of infrastructure necessary for specific healthy living practices. The hygienic condition of food preparation and storage areas was tied to cases of diarrhoea and vomiting (Bailie et al., 2010).

A growing but small literature has shown the materials used to construct the main floor, roof, and external walls of homes to be significantly related with diarrhoea risk in children under the age of five (Ndikubwimana, 2020). A recent analysis of the Rwanda DHS among 7474 sampled under-five children showed that having under-five children are less likely to be infected with diarrhoea if the main floor of their home is improved. Similar results were obtained in a community-based cross-sectional study of children under five in the rural North Gondar zone of Ethiopia, where it was discovered that the type of roof material was substantially related to diarrheal morbidity in this age group (Getachew et al., 2018).

The work of Tackie-Ofosu et al., (2014) further revealed that 79% of the homes had leaking roofs, a loud noise, a strong urine smell, an infestation of vermin, insects, and rats, dirty litter, insufficient lighting, fissures in the walls, poor ventilation, and leaking roofs. Lack of restrooms, kitchen facilities, adequate space, and poor ventilation in the rooms led to parents reporting an occurrence of at least one current health issue in their children, such as malaria, cough, asthma, or diarrhoea, which they linked to their living arrangements. Additionally, a pooled analysis of national representative datasets revealed that children with access to improved flooring were less likely to develop diarrhoea than children whose homes had unimproved flooring (soil, sand, clay, mud, or dung) (Tampah-Naah, 2019). Additionally, children who lived in homes with better floor materials had a lower risk of having comorbidity than their counterparts from homes with unimproved floor materials did (Afrifa-Anane et al., 2022).

On the contrary, a population-based study conducted by Mihrete et al., (2014) that analysed childhood diarrhoea among under-five children in Benishangul Gumuz Regional State, North West Ethiopia using the demographic and health survey. A total of 925 children were included in the analysis. The results of the study did not find any association between childhood diarrhoea and household floor material despite all household environmental variables showing a significant association with child diarrhoea.

2.3.5 HOUSEHOLD WEALTH QUINTILE

Several studies have found a link between household wealth and the occurrence of diarrhoea in children. Children from wealthy households are protected of diarrhoea as compared to those from poor household. This conclusion has been substantiated through a study that analysed data from 34 Sub-Saharan African demographic and health surveys together. The findings of the study

demonstrated that children hailing from households categorized as poorest, poorer, middle-poorest, and richer had an elevated likelihood of experiencing diarrhoea when compared to their counterparts from the richest households (Demissie et al., 2021). Similarly, other previous studies have shown that children belonging to the most affluent families exhibit a reduced susceptibility to diarrhoea. In accordance with a comprehensive examination of hospital records, it was observed that children from the wealthiest households faced a 42% lower risk of contracting diarrhoea in comparison to children from the least affluent households (Asamoah et al., 2016).

On the contrary, a substantial number of literatures have not established the relationship household wealth and the risk of diarrhoea in children below five years. An examination of the Ghana Multiple Indicator Cluster Survey (2006) revealed an increased risk of diarrhoea among the rural poorer, middle, richer, and rural richest. The odds were higher in rural middle, richer and richest as compared to the rural poorer (Kumi-Kyereme & Amo-Adjei, 2016). Moon et al., (2019) also did not find an association between household wealth quintile and the occurrence of diarrhoea. The researchers did not provide any possible explanation as to why wealth index was not significant in the multivariate regression analysis despite showing an association in the simple regression analysis.

2.3.6 PLACE FOR COOKING

Microbes can contaminate food at any stage of the process, from production to sale to preparation to consumption (Kirk et al., 2017). These contaminants can come from the water used, cutlery or equipment, hands, methods of preparation or handling, ingredients, dishes, or storage containers as well as where the food is prepared (Donkor et al., 2009). Therefore, it is crucial to prepare and store food in a clean manner both at home and from vendors in order to lower the danger of contamination.

A substantial number of literatures have identified that from producing to preparing food under poor hygienic condition can contaminate and make the food unhealthy for consumption (Larbi et al., 2021). There is evidence that the location of cooking is related to the occurrence of diarrhoea in children (Ameme et al., 2016). According to research conducted in Turkey and Ghana, children whose homes lacked a kitchen were more likely to suffer from diarrhoea (Ameme et al., 2016; Etiler et al., 2004). Similarly, children in Nigeria who lived in households with a private kitchen had lower rates of diarrhoea than those who did not (Oni et al., 1991). Furthermore, children of households having cooking place inside the sleeping rooms had increased risk to experience diarrhoea resulting in stunting than those of households having separate cooking place (Das et al., 2008). The cleanliness of the kitchen floor was found to be significantly related to the prevalence of diarrhoea among Nicaraguan children (Gorter et al., 1998). A case-control study in Myanmar found that children who ate food that had been left on the kitchen floor were significantly more likely to have persistent diarrhoea (Albert et al. 1999).

2.4 CHILD'S CHARACTERISTICS AND RISK OF DIARRHOEA INFECTION

2.4.1 AGE

Diarrhoea disease remains a global public health threat (Mohammed & Tamiru, 2014). The disease is most common in children under the age of five, particularly in low- and middle-income countries. Several published works on child diarrhoea report an association between a child's characteristics such as age, gender, and birth order and diarrhoea morbidity (Moon et al., 2019; Shine et al., 2020). Importantly, diarrhoea is reported to be more common in children aged 6-11 months and 12-24 months. At these ages, the chances of developing diarrhoea are twice as high as in children aged 0-5 months or more than 24 months.

Children aged 6-11 months and 12-24 months are more likely to develop diarrhoea, which has been linked to supplementary feeding and other developmental stages. Children of this age are fed other foods in addition to breast milk. The child's likelihood of acquiring diarrhoea is influenced by the primary caregivers' food handling and hand hygiene habits. Additionally, children between the ages of 6-11 months and 12-23 months are either crawling or walking and can readily choose dirt or other contaminated materials for playing with or eating. The work of Mihrete et al., (2014) found that the age of a child and birth order were significantly associated with childhood diarrhoea morbidity. When compared to age categories of 0-5 months, the risk of diarrhoea morbidity was higher at 6-11 months and 12-23 months, and reduced at 24 months and older.

Similarly, a population-based cross-sectional study in Ghana revealed that children in the 6–11, 12–23, and 24–59 months age groups had, respectively, 3.48, 4.57- and 1.93-times increased odds of getting diarrhoea infection compared to those in the youngest age category 0-5 months (Amugsi et al., 2015).

Recent community-based cross sectional study designs also report higher risk of diarrhoea infection among children within the age bracket 6-11 and 12-24 months. In Ethiopia, children age 6-23 months were 2.46 times higher odds of diarrhoea compared to children less than six months (Workie et al., 2019). Similar studies also show an increased risk of exposure of a child to diarrhoea after surviving the first six months of life (Bado et al., 2016; Tareke et al., 2022). The risk is further heightened at the age of 12-23 months (Tareke et al., 2022). Children aged 6-11 months (7.48 times), 12-23 months (11.64 times), and 24 months and older (8.97 times) had a significantly higher likelihood of developing diarrhoea compared to those younger than 6 months. (Asfaha et al., 2018).

Other studies conducted do not report a child's age as a factor associated to diarrhoea (Beyene & Melku, 2018; Gedamu et al., 2017). These studies report other factors such as maternal educational

level, poor waste disposal, water quality and others as significant association between a child and diarrhoea outcome (Demissie et al., 2021; Negesse et al., 2021). For instance, a cross-sectional survey conducted in Kaduna indicated infants whose mothers sometimes 2.32 times or never washed 2.64 times their hands with soap after cleaning the infant's perineum and those with incomplete age-appropriate immunization 1.87 times were more likely to have diarrhoea (Dairo et al., 2017).

In Ghana, the current age of a child is associated to the chances of a child developing diarrhoea. The odds of a child getting diarrhoea is higher among children aged between 6-11 and 12-23 months as compared to those age 0-5 months. A study that analysed data from a national representative survey revealed in the multinomial analysis children aged between 6-11 months and 12-23 months had 2.06 and 2.37 times more likely to be infected with diarrhoea respectively. Children aged below six months had lower odds (Apanga & Kumbeni, 2021). These findings have further been strengthened by (Afitiri et al., 2020; Afrifa-Anane et al., 2022). And this may be because, at that age, children age between 0-5 months are still breastfeeding and had not been introduced to street foods or feeding with bottles which could be a potential vehicle for diarrhoea-disease causing microbes to transmit. Similarly, a review of hospital records of children below age five who attended War Memorial Hospital-Navrongo and were diagnosed of diarrhoea indicated the most affected age group of children with diarrhoeal diseases was between 0-11 months old than those aged 12-59 months (Anyorikeya et al., 2016). The possible reason why children in the age bracket 12-23 months did not have higher odds of developing diarrhoea could be due to how the age of children were categorized and analysed.

Another characteristic of a child that protects him/her is rotavirus vaccination. Rotavirus vaccination has been proven to significantly reduce diarrheal hospitalizations (Enweronu-Laryea

et al., 2014; Patel et al., 2011) and deaths (Carmo et al., 2011; Enweronu-Laryea et al., 2014). Studies conducted in Africa on the impact of rotavirus vaccination on rotavirus diarrhoea show it is effective and efficacious in preventing rotavirus diarrhoea, severe rotavirus diarrhoea, and rotavirus hospitalizations among children below the age of five (Lamberti et al., 2016; Weldegebriel et al., 2018). An analysis of rotavirus-associated diarrhoea hospitalizations among children <5 years at three sentinel sites from 2009 through 2011 in South Africa showed that children less than five years testing positive for rotavirus decreased by 46%, 33%, and 29% in 2009, 2010, and 2011 respectively. In terms of hospitalizations, there was a 61% and 69% reduction among infants for the period 2010 and 2011 respectively.

In general, these studies have proven that the age of a child below five years is associated to diarrhoea outcomes. Children aged above five months are more likely to be infected with diarrhoea than those below six months. This is because unhygienic complementary feeding practices and the child's life developmental stages are contributory factors.

2.5 MOTHER/CAREGIVER CHARACTERISTICS AND THE RISKS OF DIARRHOEA AMONG CHILDREN UNDER FIVE YEARS IN GHANA

2.5.1 MATERNAL EDUCATION

The role of maternal education in child survivorship is well documented and established in many pieces of literature on health in developing countries (Desmennu et al., 2017; Guillaume et al., 2020). These studies have found consistent findings and correlations between maternal education and the risks of child diarrhoea in children under the age of five (Mihrete et al., 2014; Nguyen et al., 2021; Victoria et al., 1992). Children belonging to educated mothers have a lower risk of diarrhoea than children belonging to mothers with low-level education (Asfaha et al., 2018). Also,

the risk of a child getting diarrhoea reduces as the mothers' education level increases. Children of mothers with no education in SSA nations have higher odds of having diarrhoea, while those who are well-educated have fewer chances of getting diarrhoea (Demissie et al., 2021). Educated mothers are more likely to practice good hand hygiene, and manage and properly dispose of waste (Gyimah, 2003).

Education empowers women to willingly decide to send their children to the hospital for healthcare services (Greenaway et al., 2012). Women who are educated have a greater advantage to have sources of income. Women without access to a source of income is a great challenge that impedes them to use health facilities specifically in developing countries (Essilfie et al., 2020). A mother's education plays a vital role in a child's health (Ugboko et al., 2020). Mothers with at least primary education can protect their children from diarrhoea in the instance of poor sanitary conditions at home and their surroundings (Mohammed & Tamiru, 2014). In Bangladesh, children under the age of five were twice as likely to have diarrhoea if their mothers were uneducated (Chowdhury et al., 2016).

On the other hand, some researches have contested the idea that maternal education and the risk of diarrhoea in young infants are related (Desai & Alva, 1998; Ward et al., 2021). While many academics argue that maternal education is a significant factor in determining a child's health (Desmennu et al., 2017; Victoria et al., 1992), other researchers argue that there is only a tenuous link between mother education and children's health (Buor, 2001; Desai & Alva, 1998; Ilma et al., 2019). They contend that certain research may have overstated the relationship between maternal education and outcomes for children's health. Desai and Alva (1998) present an opposing viewpoint on the causal relationship between maternal education and improved child health. They argued that though there is a strong association between maternal and child health indicators such

as infant mortality, immunization, and child height-for-age, this relationship may be a result of a spurious relationship and not necessarily the education of the mother and improvement in the child's health. After adjusting for individual socioeconomic characteristics and community effects, their findings from an analysis of demographic and health surveys from 22 developing countries revealed that the effect of maternal education on infant mortality and children's height-for-age was statistically significant in only a small number 7 of the countries. Hence, the claim that maternal education affects child health should be made with caution. Furthermore, a study that used Ghana Demographic and Health Survey data from 1998 and World Bank data from 2000 to examine the impact of mothers' education on childhood mortality in Ghana discovered that maternal education was inversely related to childhood mortality. Children born to mothers with high education had a low mortality rate. For neonatal deaths and infant deaths, children of mothers with primary education had more child death than those of no education (Buor, 2001).

All these studies suggest there exists a strong positive association between maternal education and the incidence of child diarrhoea. Educated mothers practice good hygiene and better child feeding, which all contribute to a child's resistance to infectious diseases. Nonetheless, a handful of published literature reveals otherwise. Despite the mixed findings these works of literature show, the influence of maternal education on a child's diarrhoea cannot be underestimated. Therefore, this literature review agrees to the hypothesis that a mother's education influences the incidence of diarrhoea in children below the age of five years.

2.5.2 PLACE OF RESIDENCE

According to studies from Ghana, children who live in rural settings are less likely to contract diarrhoea than children who live in urban settings (Kumi-Kyereme & Amo-Adjei, 2016). This

discovery is similar to findings from other studies (Apanga & Kumbeni, 2021). The urban health penalty, which maintains that a disproportionate number of people with poor health live in cities where there is a concentration of the poor and unsafe conditions may help to explain the study's findings.

The presence of diarrhoea has been linked to district cleanliness and sanitary conditions. In terms of hygienic conditions, children below five years in the Dembia district had a three times higher probability of experiencing diarrhoeal disease than those of Sanja region in the Northwest Ethiopia (Getachew et al., 2018). These study results highlight how the location of residence affects the likelihood of experiencing diarrhoea. The environment in which children reside (whether urban or rural) may predispose them to morbidity. Tampah-Naah et al. (2019) study revealed that the place of residence had a significant impact on diarrhoea. Children in rural regions carried a heavy burden when it comes to the prevalence of diarrhoea in terms of incidence (Wolf et al., 2014).

Some factors, for example, are thought to contribute to the increased incidence of diarrhoea in rural areas, either individually or collectively. Among them are consuming tainted food, consuming unimproved water, poorly handling water, living in poverty, and maintaining inadequate sanitation and hygiene. Additionally, Kumi-Kyereme and Amo-Adjei (2016) noted that there is evidence to imply that residents of rural areas are less likely than those in urban areas to report diarrhoea, albeit insignificantly.

2.5.3 HAND HYGIENE PRACTICES

Previous studies have shown that encouraging handwashing among children contribute significantly to the reduction of the number of times a child have episodes of diarrhoea (Mohammed & Zungu, 2015). Recent review by Ejemot-Nwadiaro et al. (2021) and colleagues revealed that in high-income nations, boosting hand washing education programs and behaviour at

child day-care centres or schools prevented roughly one-third of diarrhoea occurrences. The review indicated that promotion of handwashing among children reduces child diarrhoea by 30%. Similar to this, Mbakaya (2017) systematic analysis of eight randomized control trials (RCT) emphasizes the importance of teaching children how to properly wash their hands to prevent diarrhoeal infections. The review discovered that good hand hygiene can lower the frequency of diarrhoea illnesses. Unlike Ejemot-Nwadiaro et al. (2021) and colleagues whose review places less emphasis on children in under-developed nations, where the morbidity and mortality from diarrhoea diseases in children is the largest and contributes to the majority of child fatalities, Mbakaya's evaluation mostly focused on children in underdeveloped countries, even though the majority 75% of the studies that satisfied the inclusion criteria had methodological issues.

Both Feleke et al. (2022) and Alebel et al. (2018) found a strong correlation between maternal handwashing habits and childhood diarrhoea. Feleke and colleagues' community-based cross-sectional study of children under the age of five between May 15 and May 29, 2021 in Bereh district indicated children whose mothers or caregivers washed their hands only with water during the five critical times had a higher risk of diarrhoea than children whose mothers or caregivers had to wash their hands with water and soap. Alebel and colleagues (2018) demonstrated that mothers who did not wash their hands after using the restroom were positively connected with childhood diarrhoea. Furthermore, children whose mothers practice poor hand washing (do not wash their hands after toilet, before preparing food, feeding a child, wash hands with soap under running water) are 2.33 times more likely to get diarrhoea (Mohammed & Tamiru, 2014). For example, a national survey study conducted in Tanzania among 9996 households and children aged (0-23) months showed a significant association between having WASH knowledge and childhood

diarrhoea. The study reported that, assisting a child to wash h/her hands after defecating before food, indicated a reduced incidence of child diarrhoea in the past two weeks (Bennion et al., 2021).

Overall, these studies indicate that handwashing or hand hygiene are important predictors of childhood diarrhoea. The methods that the studies included in the reviewed can surely ascertain whether cause-effect relation exist between handwashing and diarrhoea in children.

2.5.4. MATERNAL AGE

A large body of literature have examined the link between mother's age and child diarrhoea outcomes (Afitiri et al., 2020; Afrifa-Anane et al., 2022). These studies report a decline in likelihood of child's diarrhoea as the mother's age increases (Paul, 2022; Fagbamigbe et al., 2021). Children belonging to mothers age between 15 and 25 years are more likely to contract diarrhoea as compared to children of mothers age 25 years and above (Moon et al., 2019; Tampah-Naah, 2019). The reason cited by most of these studies included financial capability of mothers age between 15 and 25 years (Paul, 2022; Fagbamigbe et al., 2021). They noted that most of these mothers are still teenagers and may not have the financial capacity and knowledge to raise healthy children.

Nonetheless, a few studies report less likelihood of children belonging to mothers age 15-24 contracting diarrhoea (Okafor et al. 2022). Kapti et al. (2022) revealed that infants with a history of LBW from mothers aged 20–24 years were 0.07 times less likely to develop diarrhoea as compared to those belonging to mothers of older age. Kapti further argues that mothers of 19-24 age are young and considered older and are capable to raising healthy children.

2.6 THEORETICAL FRAMEWORK

This study was premised on the framework for studying and analysing child survival in developing countries. This paradigm was established by W. Henry Mosley and Lincoln C. Chen in 1984 (Mosley & Chen, 1984). The method makes it possible to measure morbidity and mortality in a single variable. The paradigm states that in order to have an effect on mortality, all social and economic factors that have a sizable impact on child mortality must pass through a common set of biological pathways or proximal determinants. These components include; proximate, dependent and independent variables.

Mosley and Chen grouped the proximate determinants into five broad categories. They are, maternal factors, environmental contamination, nutrient deficiency, injuries and personal illness control.

Maternal factors: The maternal factors that Mosley and Chen argued affect the health of a child include age, the education of the mother/primary caretaker and the income.

Environmental contamination: the framework maintained that in epidemiological studies the environment is one of the routes through which disease can spread. Given the routes of disease transmission, this may be measured directly by conducting a microbial examination of collected air samples, food, water, vectors, etc. example, a microscopic examination of E. coli bacteria from human faeces is measured in food or water. Children below the age of five who live in households with human excreta spread on the compound are highly at risk of diarrhoea infection. Additionally, children under five years whose source of drinking water is from unimproved sources are vulnerable to diarrhoea infection.

Nutrient deficiency: this maintained exposure to environmental factors could result in disease development in an individual, regarding nutrient deficiency, they posit the survival of a child is influenced by the child's diet and nutrients present as well as the nutrient and diets of the mother. They believed that the mother's diet and nutrients during pregnancy affect the child's weight, and during breastfeeding, it influences the quantity and the quality and nutrients present in breast milk. Mothers who practice exclusive breastfeeding will protect children especially infants from diarrhoea diseases. Almost, they will boost the immune system of the children to fight any disease-causing microbes.

Injuries: With respect to this proxy determinant variable, Mosley and Chen assert the resultant effect of injury on children's health outcomes (morbidity or mortality). This variable attempt to measure the frequency of child's injury within a short period of time and secondly, the total number of injuries that have harm the health of the child. This could be burns sustained or other accidental injuries.

Personal illness control: Educated mothers are more likely to send their children to welfare clinic for rotavirus vaccination, zinc tablet supplement, severe diarrhoea treatment or management and finally, they are likely to initiate or give their children experiencing diarrhoea with oral rehydration solution. Again, mothers/caregivers with education will ensure the bottles used to feed children are well-cleaned and kept hygienically to prevent transmission of diseases like diarrhoea.

The next variable the framework examines are the socioeconomic determinants (independent variables). Mosley and Chen contend that these variables work in conjunction with the proximate determinant to determine the degree of growth faltering and death. Individual productivity (fathers, mothers), traditions/norms/attitudes, and are three main categories of variables that make up the socioeconomic determinants and are frequently followed by individual-level variables. Income and

wealth variables at the household level. Ecology, politics, and the economics are community level variables, as is the health system.

This study adapts four level variables from Mosley and Chen's analytical framework. These variables are (individual, community, health, and environment). For the individual variables, the study includes maternal age, maternal education, child sex, and age of the child. The study considers the place of residence as the community-level variable. The environmental factors include the type of flooring, the type of roof, the type of main outer wall, the type of toilet, and the availability of handwashing facilities. The independent variables will be the individual and community levels, while the environmental factors or variables will be the proximal determinants of health.



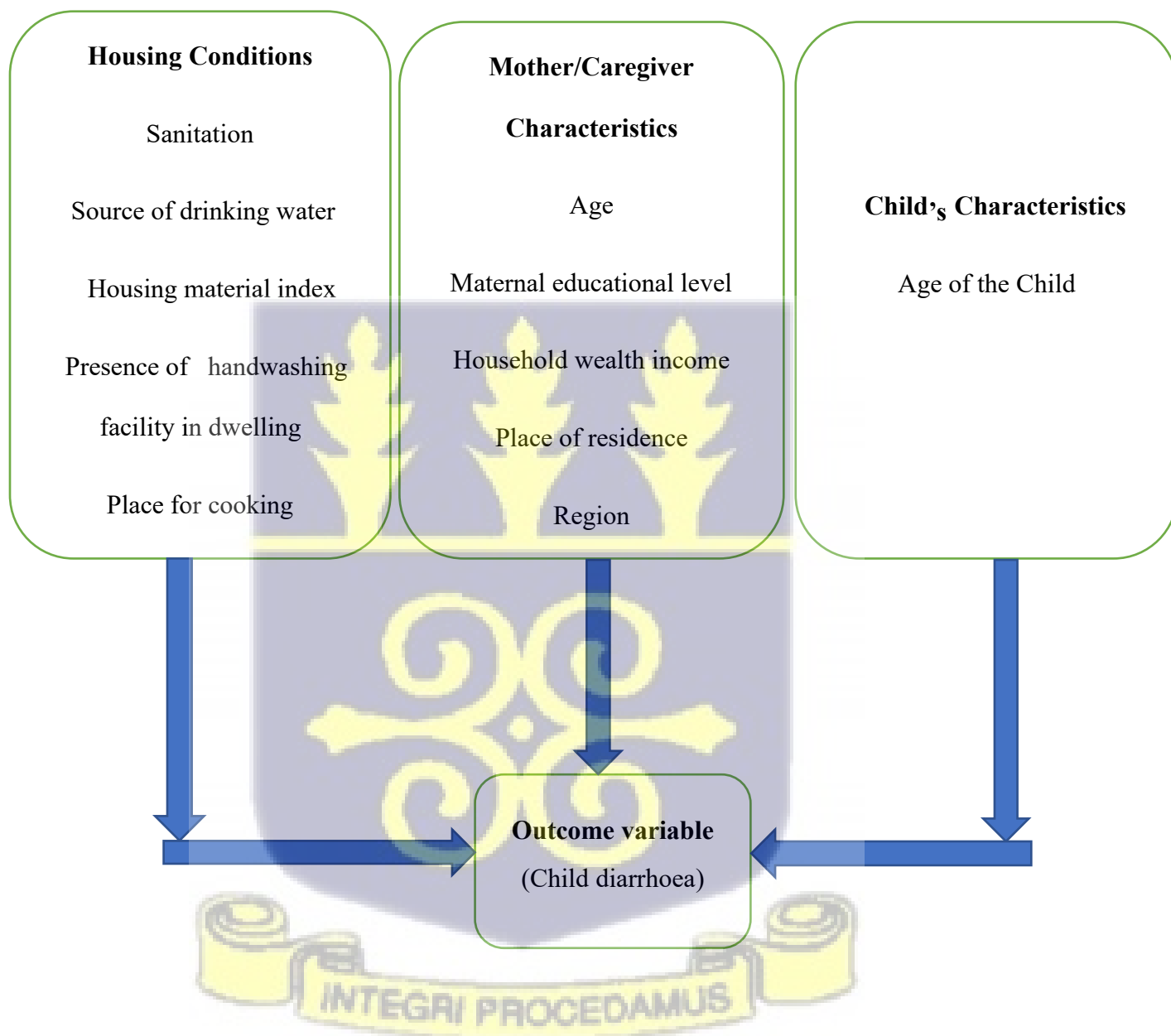
2.7 CONCEPTUAL FRAMEWORK

The figure below demonstrates the relationship and/or the interaction between selected variables at the different determinants as discussed in Mosley and Chen's analytical framework in 1984 and how it influences child morbidity, specifically, the housing conditions and the incidence of diarrhoea among children under five years in Ghana. Using Mosley and Chen's analytical child survival framework, this study included demographic (child's age), socioeconomic (e.g., household wealth quintile), proximate determinants (maternal and child nutrition) variables.

The mechanism in which these variables influence child's health (morbidity/mortality) are shown in the figure below. An example is, the mother's characteristics which is put under the broad proximate determinants can directly influence the child's health outcome (diarrhoea or no diarrhoea).



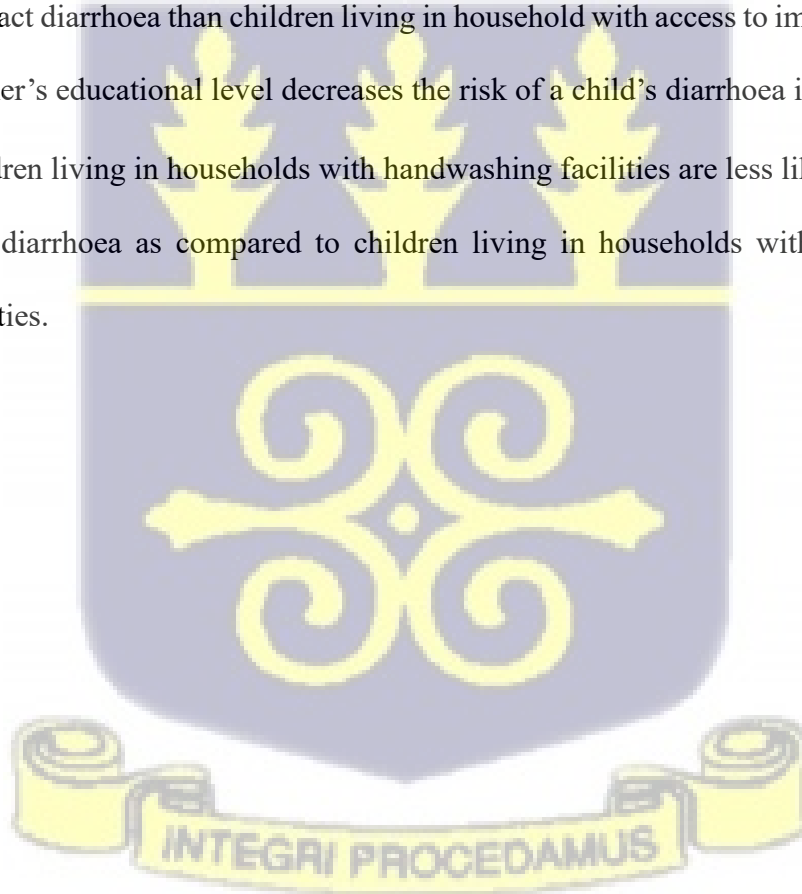
Figure 2.7.1 Conceptual Framework for Housing Conditions and the Incidence of Diarrhoea among Children Under Five Years in Ghana Integrating Mosley and Chen Analytical Child Survival Framework.



2.8 HYPOTHESES

This study hypothesized that;

1. Children living in houses with unimproved housing materials are more likely to contract diarrhoea than children living in houses with improved housing materials.
2. Children living in household without access to improved water are more likely to be infected with diarrhoea than children living in household with access to improved water.
3. Children living in household without access to improved sanitation are more likely to contract diarrhoea than children living in household with access to improved sanitation.
4. Mother's educational level decreases the risk of a child's diarrhoea infection.
5. Children living in households with handwashing facilities are less likely to be infected with diarrhoea as compared to children living in households without handwashing facilities.



CHAPTER THREE

3.0 METHODOLOGY

3.1 INTRODUCTION

This chapter describes the research approach that was employed to study the “Housing Conditions and the Incidence of Diarrhoea among Children Under Five (5) Years in Ghana. The chapter describes in brief the setting of the study, the source of data used for the study, the study design adopted. Additionally, this chapter describes the sampling procedure utilized, the method applied to gathering data from the study participants as well as the data collection tool used to gather data from the study’s participants. In furtherance, the chapter details how the variables employed for the study were measured and finally, the statistical analytical software package used and the various kinds of analysis utilized.

3.2 STUDY SITE DESCRIPTION

Ghana is located in the western part of the African continent. It is located along the Gulf of Guinea coastline. According to the recent population and housing census in 2021, there are 30,832,019 people living there in total (Ghana Statistical Service [GSS], 2021). It covers a sizable area of 238,535 km² (92,099 sq. mi), comprising a diversity of biomes from tropical rainforests to coastal savannas. Ghana's capital city is Accra. Ghana's neighbours to the north, east, south and west are Burkina Faso, Togo, the Gulf of Guinea, and Côte d'Ivoire, respectively.

Ghana was made up of 10 administrative regions. Currently it has sixteen administrative regions. The Akan ethnic group is the major ethnic group in Ghana. Christians comprised about two-thirds of all religious divisions in the country. Rice, fufu (mashed cassava, plantain, or yam), kenkey, or banku (fermented maize meal) are common carbohydrate staples served with a sauce or stew in a

traditional Ghanaian dinner. Ghana has a diverse population that speaks more than 250 languages and dialects. The official language of the nation, English, is used most often in official and commercial transactions. Additionally, schools and colleges adopt it as their primary language.

Ghana's economy has historically been based mostly on the export of cocoa, and it is currently one of the biggest cocoa exporters in the world. Nearly half of Ghanaians make their living from agriculture, which continues to be a significant economic sector. The country is rich in natural resources. Ghana is one of West Africa's wealthier countries due to its natural resources, which include oil, bauxite, manganese, gold, and diamonds. contamination of the water and deterioration.

The majority of the nation's hospitals and clinics are run by the government and various Christian organizations. Examples of supplemental services include health facilities, pharmacies, and changing rooms (first-aid centres). Although there has been a tremendous improvement in the quantity and calibre of healthcare facilities and medical staff, the demand for resources is still being exceeded by the population expansion.

Ghana has one of the most sophisticated educational systems in West Africa. Basic education consists of two years of kindergarten, six years of primary school, and three years of junior secondary school. Students then finish three years of senior secondary school, which includes courses and vocational training that prepare them for further study at the university or other third cycle coursework at highly regarded polytechnics and specialized institutes. Basic education is both free and required. In 2017, senior secondary education became free. The University of Ghana (founded 1948) has campuses in Legon and Accra, the Kwame Nkrumah University of Science and Technology in Kumasi (1951), the University of Cape Coast (1962), the University of Education in Winneba (1992), and the University for Development Studies in Tamale (1992).

3.3 DATA SOURCE

The primary source of data is the Ghana Multiple Indicator Cluster Survey (MICS), 2017/2018. GSS collaborated with the Ghana Health Service (GHS), the Ministry of Health (MoH), the Ministry of Sanitation and Water Resources (MoSWR), the Ministry of Education (MoE), and the Ministry of Gender, Children, and Social Protection to conduct the study (MoGCSP). The World Bank, UNICEF, and other partners such as the Korea International Cooperation Agency (KOICA), the United Nations Development Program (UNDP), the United States Agency for International Development (USAID), and the Korea International Cooperation Agency (KOICA) provided technical and financial assistance through the Statistics for Results Facility-Catalytic Fund (SRF-CF).

The survey's objective was to gather information on indices of children's and women's well-being at the national, rural, and urban levels as well as for the ten administrative areas that existed at the time.

3.4 STUDY DESIGN

The MICS 2017/2018 used a cross-sectional sample design to collect data on several indicators regarding children, women, and men across the country, stratified into urban and rural areas as well as the ten geographical regions of Ghana at the time data was collected.

3.5 SAMPLING METHOD

The primary characteristics of the sampling technique utilized for the survey included; the target population, the sample frame, the sample allocation, the listing in chosen clusters, the selection of the area, the selection procedure, the stratification, and the computation of sample weights. The GMICS sample frame was based on the 2010 Population and Housing Census (PHC). The survey sample was then chosen using a multi-stage, stratified cluster sampling approach. The first stage

of sampling involved identifying households in enumeration areas (EAs) described for the 2010 PHC enumeration. Then, in the second stage, a list of households was created in each sampled EA, and a representative of households was chosen.

The smallest regions received at least 60 sample clusters (primary sampling units), with the Greater Accra Region receiving up to 86 sample clusters. Within each region, sample clusters were distributed between urban and rural strata in proportion to the size of the corresponding populations in the frame. Clusters (primary sampling units) were assigned to each region's urban and rural strata in proportion to the number of households in the census frame for that stratum. The number of households selected per cluster for the MICS Ghana 2017/18 was determined by a number of factors, including the design effect, the available budget, and the time required per team to complete one cluster. Women in their reproductive age between the ages of 15 and 49 were eligible to participate in the survey. A total of (13,202) households were sampled across the country's ten regions, with (8,879) mothers/caretakers and (8,902) children under the age of five eligible and recruited.

3.6 DATA COLLECTION METHOD

The survey used computer-assisted personal interviewing (CAPI) to collect information from participants (CAPI). The CSPro (Census and Survey Processing System) software, Version 6.3, was used, which included a MICS-specific data management platform. The survey adhered to the global MICS's standard program and procedures. This has been updated to reflect the MICS 2017/2018 final questionnaires. The CAPI application was tested in the Central Region in August 2017. Based on the results and issues identified, changes were made to the questionnaires and application.

3.7 QUESTIONNAIRES

The 2017/2018 MICS collected information using questionnaires on: 1) all de jure household members (usual residents), the household, and the dwelling; 2) a water quality testing questionnaire administered in 5 households in each cluster of the sample; 3) a questionnaire for individual women administered in each household to all women aged 15-49 years; and 4) a questionnaire for individual men administered in each household to all men aged 15-49 years. The survey respondents' socio-demographic characteristics included age, gender, marital status, educational level, place of residence, occupation, religion, ethnicity, and child sex. The data collection spanned between September 2017 and January 2018.

3.8 MEASUREMENT OF VARIABLES

3.8.1 DEPENDENT VARIABLE

The study's dependent variable is child diarrhoea. In the survey (GMICS), mothers and other caregivers of children under the age of five were questioned whether their "child has had diarrhoea" in the previous two weeks. The response was a "YES or NO". A child was classified as having diarrhoea if the mother/caregiver responded "Yes" to the question "has the child had diarrhoea in the last two weeks preceding the survey". A child was categorized as not having diarrhoea if the mother/caregiver responded "NO" to the question "has the child had diarrhoea in the past two weeks preceding the survey."

3.8.2 INDEPENDENT VARIABLES

The independent variables included housing material index, source of drinking water, sanitation, presence of fixed facility for handwashing. A housing material index was computed. A housing material refers to the building materials used to construct the housing unit in which a child lived

in. This housing material index was categorized into improved and unimproved house. An improved house comprised of a house made of any of the main material of dwelling floor, roof and exterior wall classified as improved or finished by the Ghana Multiple Indicator Cluster Survey report (2017/2018). Parquet or polished wood, vinyl or asphalt strips, carpet, terrazzo, metal/tin/corrugated, iron sheet, wood, calamine/cement fibre, ceramic tiles, cement, roofing shingles, slate/asbestos, cement, stone with lime/cement, bricks, cement blocks, wood planks, and slates/asbestos are all components of an improved housing material while an unimproved housing material comprised of earth / sand, dung, wood planks, palm / bamboo, stone thatch / palm leaf/raffia, rustic mat, palm / bamboo, wood planks, cardboard/polythene sheet, mud/mud brick/earth, cane / palm / trunks, earth/mud/mud bricks, bamboo with mud, stone with mud, plywood, and cardboard.

In furtherance, a place for cooking referred to the space within the building or structure in which a household cooks food. A place for cooking was grouped into three, mainly; children of households that cooked in separate room in the main building. Children of household that cooked in same room in the main building and lastly, children of household that cooked in the open space in the main building.

Other housing features were access to clean water, sanitary conditions, and a wealth index. Five quintiles of household wealth were determined using principal component analysis (poorest, poorest, middle, richest, and richest). In addition, the participants' handwashing practices were categorized as either using a handwashing station at home or not. Both prior research and the relevant data that were present in the MICS data sets had an impact on our choice of variables.

The WHO/UNICEF Joint Monitoring Programme for Water Supply, Sanitation, and Hygiene classified drinking water sources as "improved" or "unimproved" (JMP). Drinking water from

piped water or tube wells, boreholes, protected dug wells, tanker trucks, protected springs, packaged water, and rainwater were all considered improved water sources whereas unimproved water includes water originating from streams, rivers, dams, lakes, ponds, irrigation and canal channels, unprotected springs, unprotected dug wells. In terms of sanitation, households that used bucket latrines, hanging latrines, or pit latrines without slabs or platforms, were unimproved whilst households that used pit latrines with slab, flush/pour flush toilets, ventilated improved latrines, and composting toilet were categorized as improved sanitation.

Characteristics of the mother and the kid were also taken into account as independent variables. Based on information from earlier literature, it was determined that the age of mothers or caregivers, the location of the household, the level of education, and the age of the child might all have an effect on the likelihood of diarrhoea occurring among children under the age of five in Ghana. The literature has identified a number of variables as diarrhoea predictors. The mother's age, place of residence (urban, rural, or regional), and degree of education were among the maternal characteristics. The sex and age of the child were measured as categorical variables and were considered to be child-related characteristics.

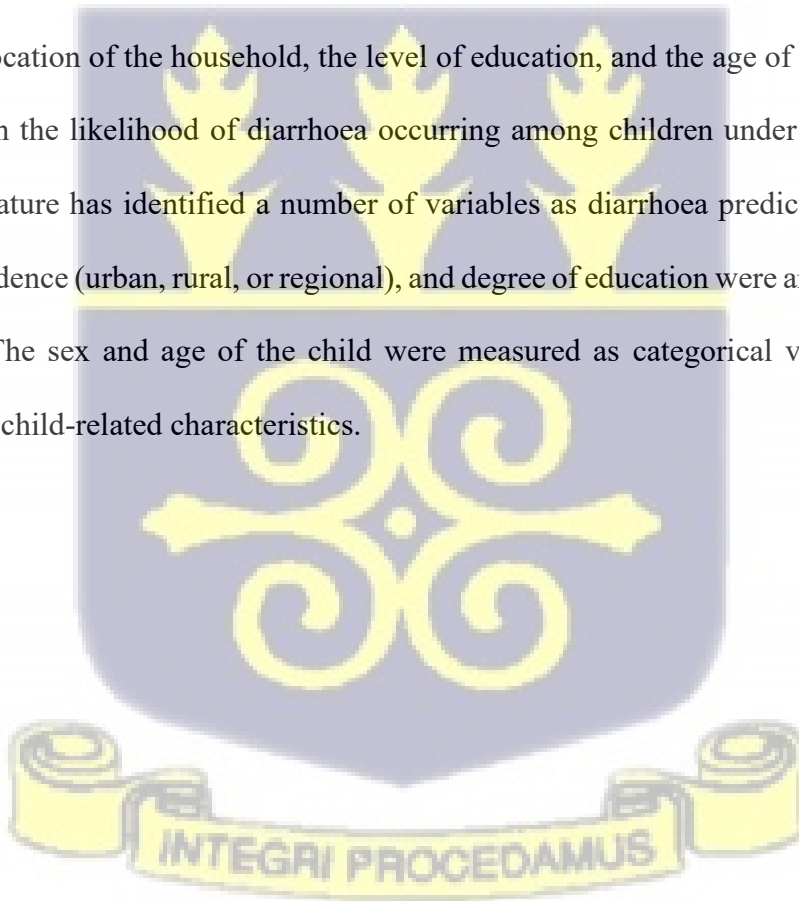


TABLE 3. 1 A TABLE SHOWING HOW THE VARIABLES WERE MEASURED.

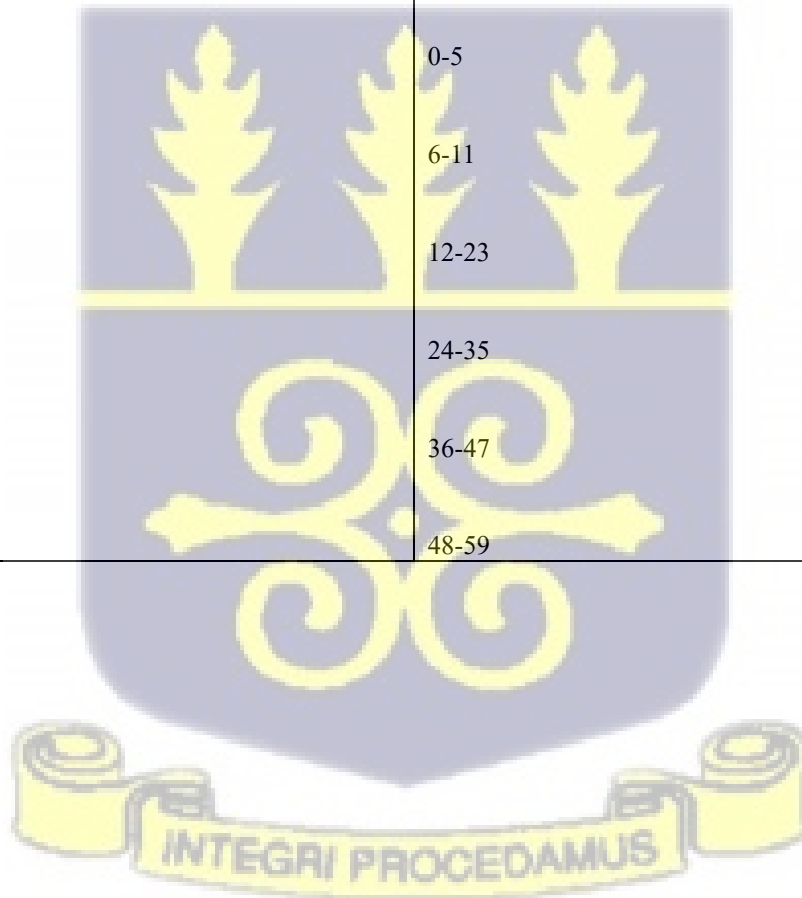
Variables	Measurement
Incidence of an episode of diarrhoea within the past weeks	Yes No
Housing material index	Improved Unimproved
Water and Sanitation	
What is the major water source in your home that members of your family utilize for other activities like cooking and handwashing?	Improved drinking water Piped water Piped into dwelling Piped to yard/plot Piped to neighbour Public tap/standpipe Tube well/borehole



	Dug Well Protected Well Unimproved drinking water Unprotected Well Spring Protected Spring Unprotected Spring Rainwater Tanker-Truck Cart With Small Tank Surface Water (River, Dam, Lake, Pond, Stream, Canal, Irrigation Channel) Packaged Water Bottled Water Sachet Water Other (Specify)
Sanitation	Improved toilet facilities flush / pour flush to the piped sewer system flush to septic tank flush to the pit latrine flush to open the drain flush to don't know where

	pit latrine ventilated improved pit latrine pit latrine with slab Unimproved toilet facilities pit latrine without slab / open pit latrine with a seat composting toilet bucket hanging toilet / hanging latrine mobile toilet no facility/bush/field other (specify)	
Where do you or other members of your household most often wash your hands?	Presence of handwashing dwelling fixed facility (sink/tap) indwelling in yard/plot mobile object (bucket/jug/kettle)	facility in

	No handwashing facility in dwelling no handwashing placed in dwelling/yard/plot other (specify)
Place for cooking	Space Separate room No separate room Open space
Age of the Child	Months 0-5 6-11 12-23 24-35 36-47 48-59

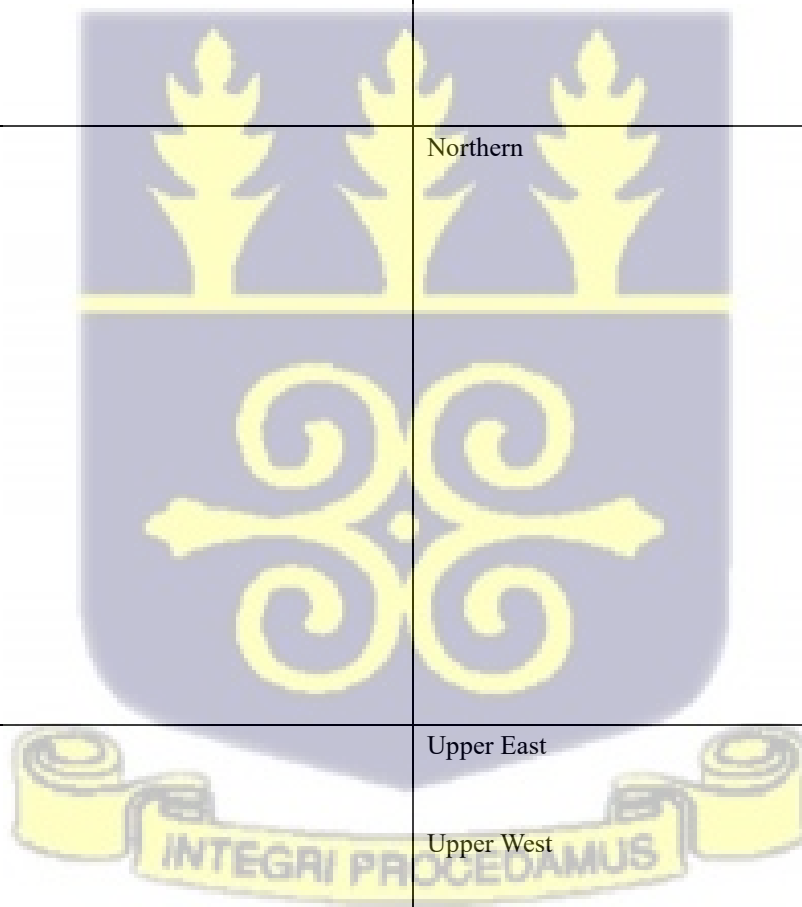


Sex of the child	Male female
Mother/caregiver's age	Years 15-19 20-24 25-29 30-34 35-39 40-44 45-49



Maternal education	Level No Education Primary JHS/JSS/Middle SSS/SHS/Secondary High
Household wealth quintile	Level Poorest Poor Middle Rich Richest
Place of residence	Setting Urban Rural

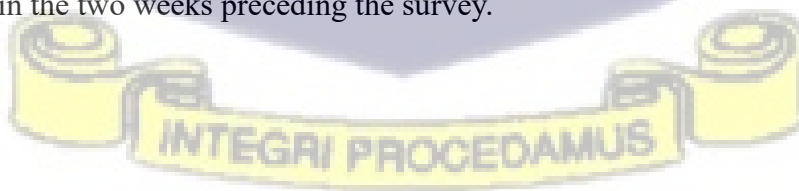
Region	Greater Accra Central Western Volta Eastern Ashanti Brong Ahafo
	Northern
	Upper East Upper West



3.9 DATA ANALYSIS

The child, women, and household data files were merged using STATA version (15.1). The total number of children below the age of five years was (8,903). For WRA, they consisted of (14,609) and the total households were made up of (13,202). After merging all three data set files, the total number of children below the age of five years matched to mothers was (8,241). From there, the analysis software was set to survey analysis using the command “svyset” in STATA. Then sample weighting was applied to do away with over and under-representation of participants in the survey.

Three levels of analysis were performed. First, univariate analysis was run for all the variables included in the study’s conceptual framework. The univariate analysis revealed the total frequencies, and the distribution for each of the independent and the dependent variables. The next analysis involved crosstabulations and Chi-square test. This analysis involved tabulating each independent variable against the dependent variable (child diarrhoea). This type of analysis aids in indicating the test of association between the independent variables and the dependent variable. Finally, the final analysis included a binary logistic regression. This constituted regressing the dependent variable against the independent variables that the study conceptualized to influence the incidence of diarrhoea among children under five years. A binary logistic regression was used because the dependent variable was measured as a dichotomous variable (i.e. YES/NO). “YES” response indicate incidence of diarrhoea whereas a “NO” response meant no incidence of diarrhoea among the child in the two weeks preceding the survey.



CHAPTER FOUR

4.0 THE RESULTS OF THE STUDY

4.1 INTRODUCTION

This chapter primarily presents the results obtained for the study. It describes the demographic characteristics of the study participants and their housing conditions. The chapter also describes the association between the independent variables and the outcome variable. And finally, this session presents the variables present in the households of the participants that could potentially risk them to diarrhoea infections.

4.2 BACKGROUND CHARACTERISTICS AND HOUSING CONDITIONS OF CHILDREN UNDER FIVE YEARS IN GHANA

The analysis included a total of 8,241 children below the age of five years in Ghana. A majority (73.7%) of the children lived in houses made of improved housing material. Again, more than half (59.1%) of all children had access to improved sanitation. Also, almost all (96.1%) of the children accessed water from unimproved sources. The proportion of households with a handwashing facility in the dwelling was (71.2%). Most (58.4%) of the household cooked in the open space while a considerable proportion (37.9%) cooked in separate rooms. Less than a tenth (3.6%) had no separate room for cooking.

The mean age of the children was (28.8) months. Female children under five years constituted just a little above half (50.8%) while male children constituted close to half (49.2%) of the total population. About 20.9% and 20.1% of the children were aged between (36-47) months and (1223) months respectively. Only a tenth (10.0%) and a little above a tenth (10.5%) were aged between 0-5 months and 6-11 months respectively. Besides, close to one-fourth (24.2%) of the population

belonged to the Ashanti region. Upper East and Upper West recorded the lowest (3.1%) and (2.4%) population respectively. More than half (56.7%) of the children lived in rural areas whereas 43.3% lived in urban areas. In terms of household wealth quintile, about one-fifth of all the children sampled belonged to either the poorest (21.8%), poor (20.7%), middle (19.9%), rich (19.1%), and richest (18.5%) households.

The mean age of the mothers/caregivers was (30.7) years. About one-fourth (24.6%) of the mothers/ caregivers had attained age (30-34). Just 3.9% and 4.0% of them had attained ages 15-19 and 45-49 years old respectively. Mothers/caregivers who have obtained Junior High School or Junior Secondary School or Middle School Education comprised of the largest group (37.3%). Less than a tenth (5.2%) of the mothers or caregivers had attained high education. A considerable proportion (26.1%) of them had no form of formal education.

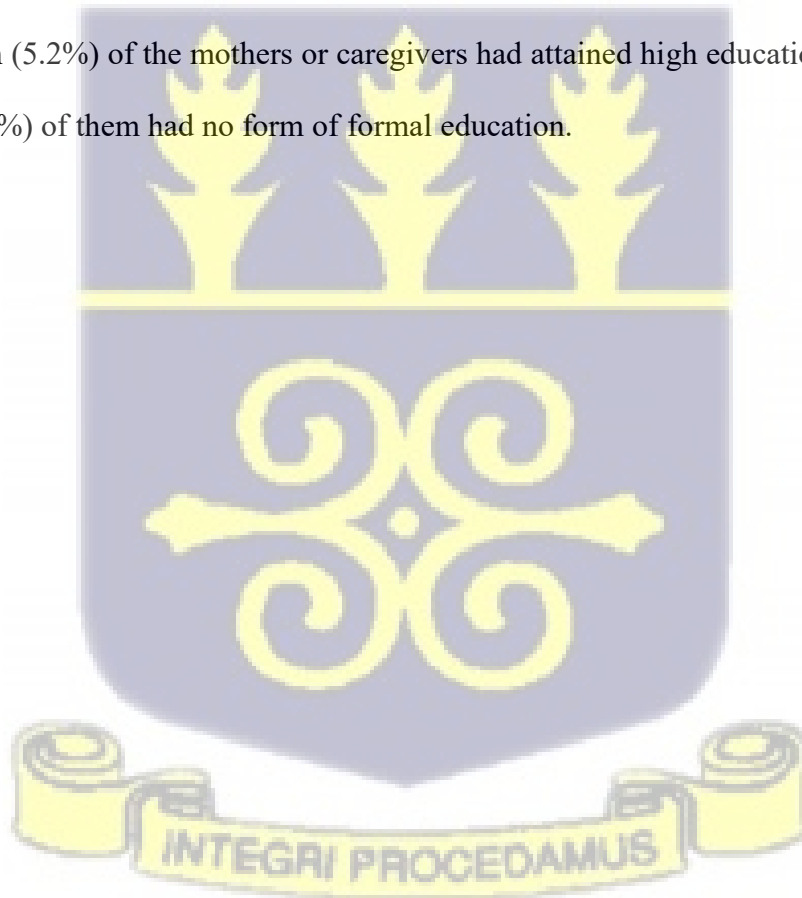


TABLE 4. 1 THE BACKGROUND CHARACTERISTICS AND THE HOUSING CONDITIONS OF CHILDREN UNDER FIVE YEARS IN GHANA

Variables	Number of Observations (N=8241)	Percent (%)
Housing Material Index		
Unimproved	2,190	26.3
Improved	6,148	73.7
Sanitation		
Unimproved	3,407	40.87
Improved	4,930	59.1
Source of Drinking Water		
Unimproved (Not treated)	8,014	96.1
Improved (Treated)	324	3.9
Presence of fixed facility in dwelling for handwashing		
Present	5,936	71.2
Not present	2,402	28.8
Place for Cooking		
Separate room	3,158	37.9

No separate room	307	3.6
Open space	4,865	58.4
Child's Age (in months)		
0-5	832	10.0
6-11	870	10.5
12-23	1,669	20.1
24-35	1,624	19.5
36-47	1,740	20.9
48-59	1,579	19.0
Sex of the child		
Male	4,104	49.0
Female	4,234	50.1
Mothers/Caregivers Age		
15-19	321	3.9
20-24	1,234	14.9
25-29	1,978	23.9
30-34	2,033	24.6
35-39	1,550	18.7
40-44	835	10.1
45-49	331	4.0

Maternal Education Level		
Pre-Primary or None	2,169	26.1
Primary	1,705	20.5

JHS/JSS/Middle	3,100	37.3
Secondary	910	10.9
High	429	5.2

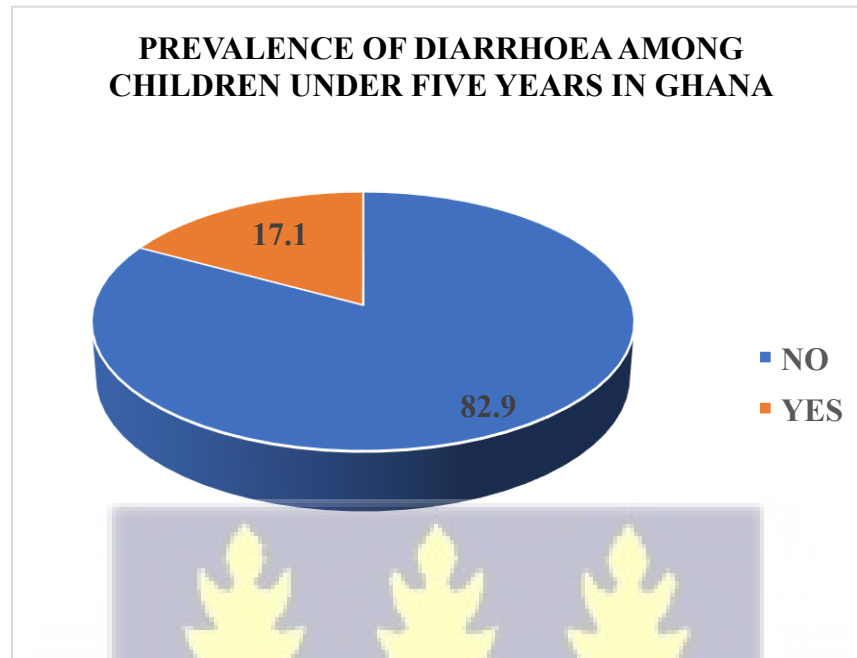
Household Wealth Quintile		
Poorest	1,818	21.8
Poor	1,723	20.7
Middle	1,660	19.9
Rich	1,593	19.1
Richest	1,543	18.5

Region		
Accra	876	10.5
Western	876	10.5
Central	809	9.7
Volta	677	8.1
Eastern	888	10.7
Ashanti	2,011	24.1
Brong Ahafo	776	9.3

Northern	968	11.6
Upper East	257	3.1
Upper West	201	2.4
Place of Residence		
Urban	3,610	43.3
Rural	4,727	56.7



FIGURE 4. 1. PREVALENCE OF DIARRHOEA AMONG CHILDREN UNDER FIVE YEARS IN GHANA



The figure above represents overall prevalence of diarrhoea among children under five years in Ghana. The figure shows that the total prevalence among children below five years in Ghana was 17.1%.

4.2.1. BIVARIATE ASSOCIATION BETWEEN THE INCIDENCE OF DIARRHOEA AND HOUSING CONDITIONS, MOTHER/CAREGIVER AND CHILD CHARACTERISTICS

The association between the housing conditions, mothers/caregivers and child's characteristics and the incidence of diarrhoea infection among children under five years in Ghana were tested in this stage of the analysis. The housing material was discovered to be statistically correlated with the incidence of diarrhoea among children. In the two weeks preceding the study, children 434 (19.9%) who lived in homes constructed of unimproved housing material reported experiencing diarrhoea while 990 (16.1%) children living in houses made of improved material recorded incidence of diarrhoea.

Regarding the presence of fixed facility in dwelling for handwashing, it was revealed that 1,072 (18.1%) children living in a household with fixed facility in dwelling for handwashing had diarrhoea as compared to 351 (14.6%) children living in a household with no fixed facility in dwelling for handwashing.

In terms of sanitation, diarrhoea infection was higher among children who had access to unimproved sanitation than their counterpart who had improved sanitation. Over 666 (19.6%) children diarrhoea infection recorded among children who had access to unimproved sanitation whereas 758 (15.4%) incidences of diarrhoea were recorded among children who had access to improved sanitation in the past two weeks preceding the survey.

The place for cooking was also found to be significantly associated with the incidence of diarrhoea among children under five years in Ghana. Children 878 (18.1%) diarrhoea infection was recorded among children of household who cooked in open space. Also, total of 79 (14.7%) of the children living in household that cooked in separate room reported diarrhoea and 26.6% incidence of diarrhoea among children living in households that cooked in no separate room in the two weeks preceding the survey.

The incidence of diarrhoea was more among children aged between 12-23 months and 6-11 months. The incidence of diarrhoea recorded among children aged 12-23 months was 24.6% and 22.1% among children 6-11 months. Children 182 (11.5%) aged 48-59 months reported the lowest incidence of diarrhoea.

From the table, it could be inferred that the rate of diarrhoea infection among children dropped as the level of maternal education increased. Children belonging to mothers/caregivers with no form of education and mothers/caregivers with primary education were the ones with the most incidence of diarrhoea infection. Four-hundred and eighty-two (22.2%) children of mothers/caregivers with

no form of education reported an incidence rate of diarrhoea infection while children of mothers/caregivers with primary level education recorded an incidence rate of (20.2%) diarrhoea infection. Children belonging to high level educated mothers/caregivers indicated the least (6.8%) incidence of diarrhoea.

With regards to household wealth quintile, the proportion of diarrhoea cases dropped as the wealth increased. Children 153 (10.0%) from the richest household wealth quintile had the least diarrhoea infection as compared to those children 394 (21.8%) from the poorest household wealth quintile. Children belonging to poor, middle, and rich household wealth quintiles recorded 18.6%, 18.1% and 16.1% incidences of diarrhoea respectively.

The three northern regions, namely; Northern, Upper East, Upper West and Ashanti recorded the highest cases of diarrhoea incidences; thus 26.2%, 22.3%, 20.3% and 20.1% in that order. Western and Central regions recorded the lowest 12.7% and 14.6% incidences of diarrhoea among children below age five respectively.

There was no statistical association observed for the following variables mothers/caretaker's age, relationship status, place of residence, source of drinking water, treated water to make it safe for drinking and main housing material, and the risk of incidence of diarrhoea among children under five years in Ghana.

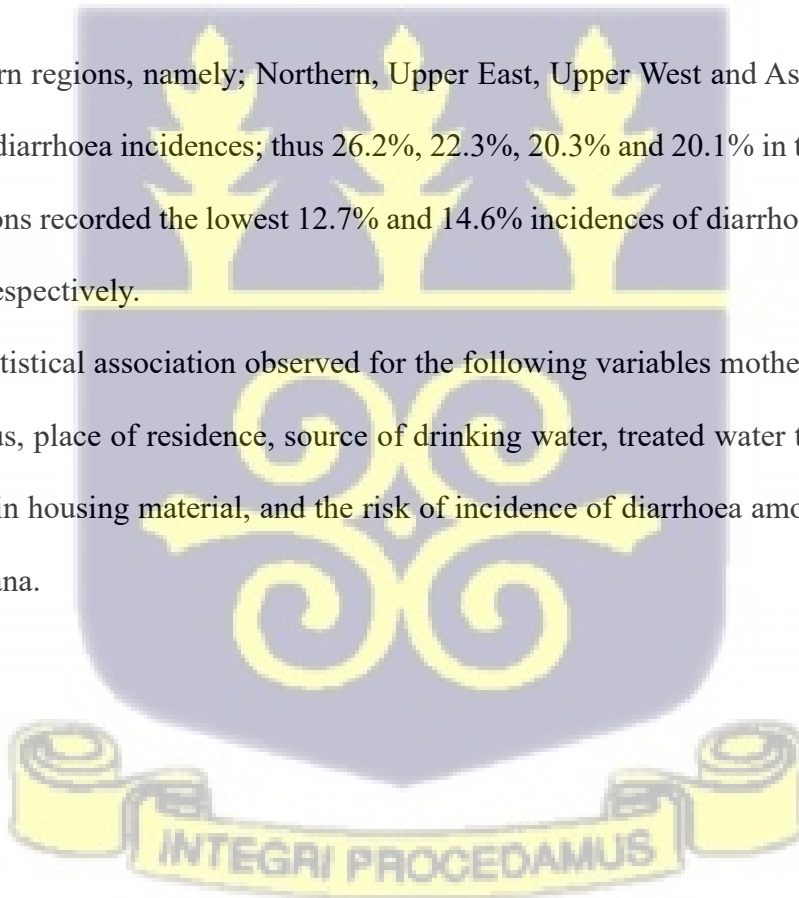


TABLE 4.2. ASSOCIATION BETWEEN DEMOGRAPHIC CHARACTERISTICS AND CHILD DIARRHEA.

Variable	The child had diarrhoea in the last 2 weeks		Chi-Square (p-value)
	NO	YES	
Housing Material Index			
Unimproved	1, 743 (80.1%)	434 (19.9%)	16.22 (0.0020)
Improved	5,146 (83.9%)	990 (16.1%)	
Presence of Fixed Facility in Dwelling for Handwashing			
Present	4,841 (81.9%)	1,072 (18.1%)	14.49 (0.0101)
Not present	2,048 (85.4%)	351 (14.6%)	
Source of Drinking Water			
Improved (treated)	6,617 (82.8%)	1,372 (17.2%)	0.36 (0.5965)
Unimproved (not treated)	272 (84.1%)	51 (15.9%)	
Sanitation			
Improved	4,159 (84.6%)	758 (15.4%)	24.56 (0.0001)
Unimproved	2,730 (80.4%)	666 (19.6%)	
Place for Cooking			
Separate room	2,689 (73.4%)	464 (26.6%)	34.23 (0.0002)

No separate room	218 (85.3%)	79 (14.7%)	
Open space	3,976 (81.9%)	878 (18.1%)	
Child Age (months)			
0-5	727 (87.6%)	103 (12.5%)	137.45 (0.0000)
6-11	677 (77.9%)	192 (22.1%)	
12-23	1,257 (75.4%)	410 (24.6%)	
24-35	1,338 (82.4%)	285 (17.6%)	
36-47	1,491 (85.7%)	248 (14.3%)	
48-59	1,396 (88.5%)	182 (11.5%)	
Sex of the child			
Male	3,372 (82.4%)	722 (17.6%)	1.43 (0.4427)
Female	3518 (83.4%)	702 (16.6%)	
Mothers/Caregivers Age			
15-19	269 (84.1%)	51 (15.9%)	25.65 (0.1143)
20-24	982 (79.6%)	251 (20.4%)	
25-29	1,617 (81.8%)	360 (18.2%)	
30-34	1,691 (83.2%)	341 (16.8%)	
35-39	1,338 (86.4%)	211 (13.6%)	
40-44	682 (81.8%)	151 (18.2%)	
45-49	278 (84.2%)	52 (15.8%)	

Mothers/Caregivers Education			
No Education	1,685 (77.8%)	482 (22.2%)	110.98 (0.0000)
Primary	1,360 (79.8%)	344 (20.0%)	
JHS/JSS/Middle	2,641 (85.2%)	458 (14.8%)	
SHS/SSS	801 (88.0%)	109 (12.0%)	
High	400 (93.2%)	29 (6.8%)	
Household Wealth Quintile			
Poorest	1,411 (78.2%)	394 (21.8%)	86.85 (0.0000)
Poor	1,400 (81.4%)	319 (18.6%)	
Middle	1,358 (81.9%)	299 (18.1%)	
Rich	1,336 (83.9%)	256 (16.1%)	
Richest	1,381 (90%)	153 (10%)	
Place of Residence			
Urban	3,021 (83.9%)	579 (16.1%)	4.84 (0.1587)
Rural	3,867 (82.1%)	845 (17.9%)	
Region			
Western	764 (87.3%)	111 (12.7%)	137.16 (0.0000)
Central	748 (85.5%)	127 (14.5%)	
Greater Accra	738 (91.7%)	66 (8.3%)	

Volta	563 (83.3%)	113 (16.7%)	
Eastern	746 (84.4%)	137 (15.6%)	
Ashanti	1,604 (80.0%)	401 (20.0%)	

Brong Ahafo	653 (85.0%)	111 (15.0%)	
Northern	713 (73.8%)	253 (26.2%)	
Upper East	198 (77.7%)	56 (22.3%)	
Upper West	159 (79.7%)	40 (20.3%)	



4.2.2 RELATIONSHIP BETWEEN HOUSING CONDITIONS, SOCIODEMOGRAPHIC VARIABLES AND DIARRHOEA INCIDENCE AMONG CHILDREN UNDER FIVE YEARS IN GHANA.

The multivariate analysis included all the variables that showed an association or not in the chi-square significant of test of association at a p-value (0.05). The variables (source of drinking water, housing material, place of residence, and mothers age) were included because, these variables have been documented to predict child diarrhoea. The analysis presents two binary logistic regression models. The first model examined the influence of housing conditions specifically, the housing materials, source of drinking water, sanitation, presence of fixed facility in the dwelling for handwashing and place of cooking on the likelihood of diarrhoea occurring in children under five years old in Ghana. The second model takes into consideration all the housing conditions, mothers/caregivers and child characteristics that is documented in previous literature to predict child's diarrhoea outcomes.

Each categorical variable had a reference category (RC) chosen, and the odds ratios of all the categories that comprised that variable were then compared to the reference category (RC) of that same variable. The results of the odds ratios demonstrate the size of each category's impact on child diarrhoea. An odds ratio of one (1) denotes the absence of a relationship, odds ratios more than one (>1) denote a greater likelihood, and odds ratios lower than one (1) denote a lower likelihood of a child getting diarrhoea after being exposed to the risk of diarrhoea.

The analyses were carried out at a 95% confidence level. A p-value of 0.05 indicates that the variable is statistically significant, and it influences the incidence of diarrhoea disease among children under the age of five in Ghana. The housing condition variables (main independent

variable) in the regression analysis included: toilet facility type, source of drinking water, housing material, cooking location, presence of handwashing facility, and household wealth quintile.

Mother/caregiver characteristics included residence, mother's age, and child's age.

4.2.3 MODEL 1. ASSOCIATION BETWEEN THE HOUSING CONDITIONS AND THE INCIDENCE OF DIARRHOEA AMONG CHILDREN UNDER FIVE YEARS IN GHANA.

A p-value less than 0.05 was considered statistically significant in this study. The overall model was statistically significant at p-value 0.0000, the degree of freedom was 192, and the F-statistic indicated that the binary logistic regression model fit the data. The F-statistic was 7.32, indicating that the predictor variables can predict the incidence of diarrhoea in children under the age of five in Ghana. The first model examined the influence of housing conditions (housing material, source of drinking water, sanitation, presence of fixed facility in dwelling for handwashing and place for cooking) on the incidence of diarrhoea among children under five years in Ghana.

The materials used to construct the home had a substantial impact on the incidence of diarrhoea among children under the age of five in Ghana, as seen in the table 4.3 below. Children who lived in houses made of unimproved homes were 1.20 times more likely to get diarrhoea than children who lived in improved material homes. The source of drinking water did not significantly correlate with incidence of diarrhoea among children under the age of five.

Sanitation was revealed to be significant in influencing the incidence of diarrhoea among children under the age of five. Children who utilized unimproved sanitation were 1.27 times more likely to get diarrhoea than children who had access to better sanitation. Again, there was a significant association between the presence of a fixed handwashing facility in the home and the incidence of diarrhoea among children under the age of five in Ghana. Children who did not have a fixed facility

in their home for handwashing were 0.74 times less likely to be infected with diarrhoea than children who did have a fixed facility in their home for handwashing.

Furthermore, it was discovered that the location of cooking affects the incidence of diarrhoea in children under the age of five. Children in households with no separate room for cooking and those who cooked in the open were 1.86 and 1.25 times more likely to get diarrhoea than children in households with a separate room for cooking.



TABLE 4. 3. MODEL 1. ASSOCIATION BETWEEN HOUSING CONDITIONS AND THE INCIDENCE OF DIARRHOEA AMONG CHILDREN UNDER FIVE YEARS IN GHANA.

Variables	OR (95% CI)	p-value
Housing Material Index		
Improved	Ref	
Unimproved	1.20 (1.01, 1.42)	0.038
Source of Drinking Water		
Improved (Treated)	Ref.	
Unimproved (Not Treated)	1.51 (0.91, 2.48)	0.107
Sanitation		
Improved	Ref.	
Unimproved	1.27 (1.09, 1.48)	0.002
Presence of fixed facility in dwelling for handwashing		
Present	Ref.	
Not present	0.74 (0.61, 0.90)	0.004
Place for Cooking		
Separate room	Ref.	
No Separate room	1.86 (1.26, 2.74)	0.002
Open space	1.25 (1.04, 1.49)	0.015

After controlling for other factors such as the mother/caregiver and the child characteristics in the second model, the model revealed that children of households with facility for handwashing were 1.27 times more likely to contract diarrhoea as compared to children of households with no fixed facility in dwelling for handwashing. Besides, the place for cooking was significant after introducing other factors to the model. Children of household with no separate room for cooking were 1.66 times more likely to experience episodes of diarrhoea as compared to their counterparts who had separate room for cooking.

The age of a child (in months) showed statistical significance with the incidence of diarrhoea among children in Ghana. The risk of childhood diarrhoea peaked at age 12-23 months and then declined steadily as the child ages. Children aged between 12-23 months had higher odds of developing diarrhoea. Again, children aged 6-11 months had the second higher odds of developing diarrhoea, whereas children aged 0-5 months had the lowest chance of getting diarrhoea as compared to older children aged 48-59 months.

There was a significant relationship between maternal educational level (pre-primary, primary, and JHS/JSS/Middle). On the hand, there was no association between mothers of secondary school educational level and the incidence of diarrhoea among children under the age of five. The chances of a child getting diarrhoea decreased as the mother's or caregiver's educational level increased. Children of mothers/caregivers with pre-primary or no education had the highest risk of contracting diarrhoea. They were 2.77 times more likely as compared to mothers of high education. Furthermore, children of mothers/caregivers with a primary education were 2.6 times more likely to develop diarrhoea as compared to mothers/caregivers with high educational level. Children of JHS/JSS/Middle mothers/caregivers were 2.01 times more likely to be infected with diarrhoea as compared to the reference category. Though no significant association was observed between

children belonging to mothers/caregivers of secondary education, their odds of contracting diarrhoea was 1.61 times as compared to mothers/caregivers of high educational level.

Furthermore, the household wealth quintile was significantly associated with the incidence of diarrhoea in children. Children from the poorest households had a higher risk of developing diarrhoea than those from the richest households. A child in the poorest household was 1.73 times more likely than those in the richest category to develop diarrhoea. The likelihood of a child developing diarrhoea decreases as household wealth increases. Nonetheless, the chances of a child contracting diarrhoea in the middle category were higher than in the poorest household wealth quintile. Children from the richest household were more likely to get diarrhoea than children from the poorest household.

Furthermore, region was linked to the likelihood of a child developing diarrhoea. Using Greater Accra as the reference category, children in the Northern, Ashanti, Upper East, Upper West, Volta, Eastern, Brong Ahafo, and Central regions are more likely to experience diarrhoea than those in Greater Accra. In the regression model, there was no relationship between children in the Western region and the incidence of diarrhoea.

There was no statistically significant relationship found between housing material, sanitation, source of drinking water, child sex, mothers/caregivers age, and place of residence and the incidence of diarrhoea among children under the age of five in Ghana.



4.2.4. MODEL 2. RELATIONSHIP BETWEEN THE SIGNIFICANT VARIABLES AND RISK OF DIARRHEA INCIDENCE AMONG CHILDREN UNDER FIVE YEARS IN GHANA.

Variables	Odds Ratio (95% Confidence Interval)	P-value
Housing Material Index		
Unimproved	0.94 (0.73, 1.21)	0.671
Improved	Ref.	
Sanitation		
Unimproved	1.07 (0.88, 1.30)	0.446
Improved	Ref.	
Source of Drinking Water		
Unimproved	1.43 (0.85, 2.40)	0.165
Improved	Ref.	
Presence of fixed facility in dwelling for handwashing		
Present	1.27 (1.03, 1.58)	0.023
Not present	Ref.	
Place for Cooking		
Separate room	Ref.	
No separate room	1.66 (1.07, 2.58)	0.023

Open space	1.06 (0.87, 1.28)	0.545
Child's Age (in months)		
0-5	1.12 (0.72, 1.77)	0.615
6-11	2.32 (1.73, 3.12)	0.000
12-23	2.68 (1.98, 3.64)	0.000
24-35	1.74 (1.29, 2.34)	0.091
36-47	1.29 (0.95, 1.73)	0.093
48-59	Ref.	
Sex of the Child		
Male	1.09 (0.91, 1.30)	0.312
Female	Ref.	
Mothers/Caregivers Age		
15-19	0.84 (0.44, 1.59)	0.604
20-24	1.26 (0.84, 1.90)	0.250
25-29	1.14 (0.71, 1.81)	0.579
30-34	1.07 (0.72, 1.59)	0.719
35-39	0.79 (0.50, 1.22)	0.293
40-44	1.10 (0.68, 1.75)	0.694
45-49	Ref.	
Maternal Education Level		

Pre-Primary or None	2.77 (1.39, 5.51)	0.004
Primary	2.60 (1.31, 5.13)	0.006
JHS/JSS/Middle	2.01 (1.01, 3.98)	0.045
Secondary	1.61 (0.80, 3.24)	0.176
High	Ref.	
Wealth Quintile		
Poorest	1.73 (1.12, 2.67)	0.013
Poor	1.56 (0.99, 2.44)	0.051
Middle	1.57 (1.02, 2.43)	0.039
Rich	1.30 (0.97, 1.74)	0.069
Richest	Ref	
Region		
Accra	Ref.	
Western	1.35 (0.94, 1.95)	0.098
Central	1.66 (1.14, 2.41)	0.008
Volta	1.78 (1.17, 2.70)	0.007
Eastern	1.73 (1.20, 2.49)	0.003
Ashanti	2.45 (1.73, 3.47)	0.000
Brong Ahafo	1.68 (1.10, 2.55)	0.016
Northern	2.41 (1.66, 3.49)	0.000

Upper East	2.19 (1.47, 3.25)	0.000
Upper West	1.99 (1.36, 2.90)	0.000
Place of Residence		
Urban	Ref.	
Rural	0.80 (0.64, 1.01)	0.069



CHAPTER FIVE

5.0 DISCUSSION AND SUMMARY OF STUDY FINDINGS

5.1 INTRODUCTION

This section of the thesis is dedicated to discussing the study's findings. The findings of this study were used to compare the results of other studies in order to support or contradict previous findings. In general, the section is organized as follows: a general overview of the study's significant findings. The factors that affect children under the age of five and predict the development of diarrhoea are then all discussed. The factors that did not predict the occurrence of diarrhoea in children under five are also explored, as well as potential explanations given to why there was no link. The results are discussed considering the findings in the light of existing research studies.

5.2 OVERVIEW OF THE RESULTS

The purpose of this research was to find out about the housing conditions and the incidence of diarrhoea in children under the age of five in Ghana. Four hypotheses were proposed in the study. To begin, the study claimed that children living in unimproved housing material are more likely to contract diarrhoea than children living in improved housing material. Second, children of high education mothers/caregivers are less likely to contract diarrhoea infection than children of low education mothers/caregivers. Third, diarrhoea is less likely in children whose mothers/caregivers wash their hands. Finally, children who lack access to safe drinking water or sanitation are more likely to develop diarrhoea.

The 2-week prevalence of diarrhoea was (17.1%) among children under five years in Ghana. The place for cooking, availability of handwashing facility, mother/caregiver educational level, household wealth, region, and a child's age were identified to be significantly associated with the

incidence of diarrhoea among children under five years in Ghana. On the other hand, the study did not find any association between housing material, origin of drinking water, sanitation, mothers age, place of residence and the incidence of diarrhoea.

5.3 PREVALENCE OF DIARRHOEA AMONG CHILDREN UNDER FIVE YEARS IN GHANA

The two-week prevalence of diarrhoea (17.1 %) in this study was in line with the prevalence (16.7%) of diarrhoea reported in a community-based cross-sectional study among 1,007 mothers of young children residing in ten rural and one urban kebeles in North West Ethiopia that were randomly chosen to assess the prevalence and risk factors associated with child diarrhoea (Gedamu et al., 2017). On the other hand, the prevalence of diarrhoea in this study is higher than the prevalence of diarrhoea reported by Tampah-Naah, (2019) in which the author analysed data from the Ghana Demographic and Health Survey from 2003, 2008 and 2014 among children below two years. Nevertheless, this study reports a low prevalence of diarrhoea than what Amugsi et al. (2015) reported in their analysis of the Ghana Demographic and Health Surveys comprised of 2,790 children aged (0-59) months. They found a prevalence (20.9%) of diarrhoea in the preceding two weeks before the survey.

5.4 HOUSING CONDITIONS

This study discovered a link between having a handwashing station in the house and child diarrhoea. Children from households with a handwashing facility in the dwelling were more likely to have diarrhoea episodes than their counterparts from households without a handwashing facility in the dwelling. This result supports the findings that children of mothers with a fixed facility in dwelling for handwashing were more likely to not practice good hand hygiene (Natnael et al.,

2021). This is because the mere presence of handwashing facility in dwelling does not translate into mothers of children below five years practice hand hygiene to prevent germs and diarrhoea causing microbes transmission. The result of this study is also in line with a cross-sectional study conducted among children under five years in Pakistan to determine the factors associated with child diarrhoea. The study reported no significant associated between presence of handwashing facility and child diarrhoea (Ali et al. 2022). The plausible explanation given was that, the presence of handwashing facility in the household does not mean mothers will certainly wash their hands at crucial times such as feeding the child or preparing the child's food.

However, this finding is counterintuitive to a community based cross sectional study in Ethiopia which showed that children without handwashing facility were (2.45) times more likely to get diarrhoea (Workie et al., 2019). Given this, children of household without handwashing facility were less likely to experience diarrhoea than those with handwashing facility.

In terms of place of cooking, it was found to be statistically significantly associated with the incidence of diarrhoea among children. Children living in households with no separate room for cooking and those in household that cook in open space were 1.86 and 1.25 times more likely to contract diarrhoea as compared to children living in households that cook in separate rooms respectively. This finding agrees to what has been reported in several literature that food can become contaminated by microbes at any point in the process, from production to sale to preparation to consumption (Kirk et al., 2017; Ohene-Adjei et al., 2017). These contamination sources include the space used for cooking, the water used, the cutlery or equipment, the hands, the way the food is prepared or handled, the ingredients, and the bowls or storage containers (Donkor et al., 2009).

5.5 MOTHER/CAREGIVER CHARACTERISTICS

5.5.1 MATERNAL EDUCATIONAL LEVEL

Compared to children whose mothers or caregivers have higher educational levels, the likelihood of developing diarrhoea was higher in children whose mothers had no formal education, primary education, and junior high school education. While mothers' education increased, the chances of a child developing diarrhoea decreased. This finding agrees with the findings of other studies, in which children of mothers/caregivers with low levels of education were at increased risk of the incidence of diarrhoea (Mihrete et al., 2014; Tampah-Naah, 2019).

Mothers who have attained some levels of education are more likely to practice good health seeking behaviour for their children, utilize health services and childcare practices. Education influences the hygienic practices, child feeding, waste disposal and sanitation practices of mothers which in turn, will influence and result in better health outcomes for the child. Given this, mothers without education may lack the requisite knowledge of diarrhoea prevention and they are less likely to practice good hand hygiene.

5.5.2 HOUSEHOLD WEALTH QUINTILE

The household wealth quintile was found to be statistically significant with the incidence of diarrhoea among children below the age of five years in Ghana. Children of poorest household had the higher chances of getting diarrhoea. This finding corroborates with our hypotheses and extant literature (Kumi-Kyereme & Amo-Adjei, 2016; Negesse et al., 2021), which indicates that children of poorest household wealth quintile are at increased risk of infectious agents. This is because the poor are likely to live in unhygienic environment and engage in poor hygienic practices which increases their exposure to diarrhoea causing micro-organisms (Amugsi et al., 2015a; Apanga &

Kumbeni, 2021). Nevertheless, the finding of this study is inconsistent with other studies in Africa. For example, an analysis of the Tanzanian Demographic and Health Survey 2015-16 data showed increased risk of diarrhoea incidence observed in the two rich income brackets richer and richest household wealth quintile (Edwin & Azage, 2019).

5.5.3 PLACE OF RESIDENCE

No statistically significant association was found between place of residence and child diarrhoea in this study. The findings of this study contradicts the results of Tampah-Naah (2019) whose study analysed 2003, 2008 and 2014 GDHS data among children below two years of age. The differences in the results between the current and Tampah-Naah's could be that, Tampah-Naah's study only focused on children two-years and below. Unlike this study that examine children five-years and below. Another explanation is that, the data used in Tampah-Naah's study is old unlike the current study which used a more recent data.

Furthermore, there was a statistically significant association between the different regions of the country and the incidence of diarrhoea outcome among children under five years. Considering Greater Accra region as the reference category, the odds of a child experiencing diarrhoea was 2.47 times higher in Northern, 2.32 times in Ashanti, 2.14 times in Upper East and 1.92 times in Upper West regions respectively contract diarrhoea than the reference region. This was not quite surprising because we know diarrhoea is caused by number of environmental, climatic factors, socio-demographic and economic factors. Except for Ashanti region, the three northern regions are known to be among the poorest regions in Ghana. they have poor access to improved drinking water, sanitation, water scarcity, low level of education and even scarce water. And these factors could be the major reason why a child in those regions have higher increased risk of getting diarrhoea.

5.6 CHILD CHARACTERISTICS

5.6.1 AGE

Previous studies have demonstrated that, children aged 12-23 months and 6-11 months have greater chances of being infected with diarrhoea respectively. This result is expected as it has widely been reported in the literature that children of these ages are more likely to have diarrhoea (Moon et al., 2019). Children below six 6 months are still breastfeeding exclusively unlike children of ages 6-11 and 12-23 months who are consuming complementary; which could be contaminated with diarrhoea causing microbes. Also, breastfeeding children are more likely to develop their immune system in which they can fight any pathogens that enter their bodies (Asfaha et al., 2018).

It is worth noting that this study did not find association between these variables (mothers age, sex of the child, source of drinking water, sanitation, place of residence, housing material) and child diarrhoea. The age of a child's mother has been reported to be statistically associated with the child's diarrhoea in other studies (Edwin & Azage, 2019). This finding is relatively counter-intuitive and the possible explanation to the difference observed could be how the age of mothers were categorized in those studies (Danquah, 2015). Also, it could mean that, irrespective of mothers age, a child can potentially experience episodes of diarrhoea and the incidence does not necessary depend on the age of a mother but other factors as well which this study may have not included in the model.

Lastly, the behaviour of mothers, specifically with regards to mother's hand hygiene practices, child's waste disposal could all contribute to child diarrhoea not necessary the age of the mother as the literature reports.

Additionally, the study did not find any statistical association between source of drinking water and child's diarrhoea outcomes. Darvesh et al. (2017) highlights that WASH implementation

reduced the risk of diarrhoea among children under five years between 27% and 53%. However, the debate over improved drinking water sources and their link to diarrhoea has been inconclusive. While some studies report children of household with access to improved water sources for drinking have less chances of developing diarrhoea (McClelland et al., 2022; Workie et al., 2019), others also report no association (Begum et al., 2011). The finding of this study showed children of household with access to unimproved source of drinking water were less likely to be infected with diarrhoea. Though this finding contradicts what many literatures (Afrifa-Anane et al., 2022; Asfaha et al., 2018) have reported that children who utilized unimproved drinking water in their households were at increased risk to get diarrhoea as compared to those who had improved drinking water, the finding from this current study is in line with a study that analysed a national survey conducted in Tanzania which included 9996 households and children aged 0-23 months showed a significant association between having water sources and childhood diarrhoea (Bennion et al., 2021). That notwithstanding, the lack of statistical association observed could mean that, most of these children had access to improved water, the water was well handled, stored with quality water containers, and covered to prevent diarrhoea causing organisms infesting it.

Again, poor sanitation specifically absence of toilet facility is reported to be linked with incidence of diarrhoea among children under five years. In this study, there was no statistically significant association between sanitation and child diarrhoea. This finding corroborates what Edwin and Azage (2019) reported in their study. They noted that sanitation was not associated with childhood diarrhoea among children below five years. Children of households without improved sanitation were 1.08 times more likely to contract diarrhoea. The finding that children living in households with unimproved sanitation facilities is more likely to get diarrhoea is consistent with Tampah-Naah (2019). In his study, he found out that children whose mothers had access to unimproved

toilet facilities were more likely to have had episodes of diarrhoea compared to those with improved facilities. Improved toilet facilities separate human excreta from human contact. This, in the long run helps to prevent disease transmission either through contacts with hands, food, flies or crawling insects.

The reason why the study could not find an association in the multivariate regression analysis could be, a lot of the children lived in households with improved sanitation, the mothers practiced good hand hygiene before preparing food, feeding a child and other behaviour that helps to cut transmission of diarrhoea disease pathogens. Moreover, it could be that sanitation facilities were distant away from households. This could prevent presence of faeces around households and the possibility of the child getting in contact with it and being at risk of diarrhoea.

Though there was no association observed between housing material and child's diarrhoea, the possibility of children experiencing diarrhoea was less in children who live in houses made of unimproved material than those who lived in improved housing material (Ndikubwimana, 2020).

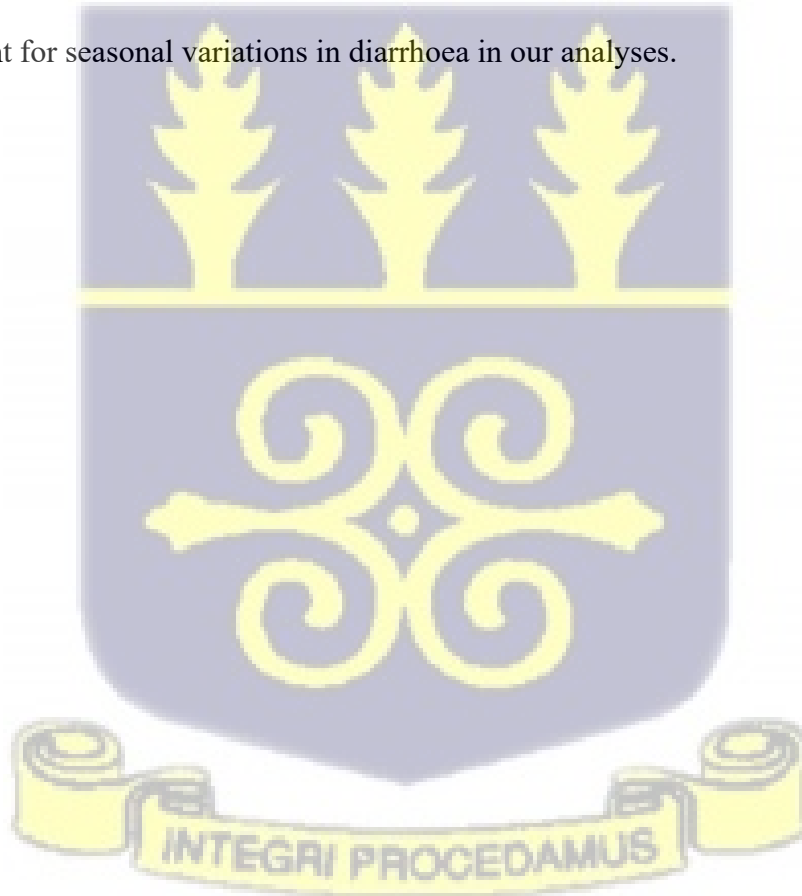
Though children start to crawl and walk about in the house, they often, try to support themselves with their hands during movement and these adapted activities brings them into contact with contaminated objects, pathogens precisely in households with natural floors. Mothers/caregivers who ensure good hand hygiene of their children are more likely to protect them from diarrhoea infection despite living in an unimproved housing material (Mihrete et al., 2014).

5.7 STRENGTHS AND LIMITATIONS OF THE STUDY

The strengths and weaknesses of this study include the following; The findings of this study can be applied to the entire nation because the MICS data is nationally representative of all children under five years in Ghana. The study, however, had several drawbacks. First, the study did not

include the rotavirus vaccination status of the child due to a significant number of missing observations that were present in the variable. Additionally, the breastfeeding status of the child was also not included in the study because of large number of missing values of the variable.

Rotavirus vaccination and breastfeeding have been known to protect children under five years of the incidence of diarrhoea. Some studies suggest rotavirus vaccination reduced child diarrhoea hospitalization substantially (Armah et al., 2016). The study is unable to conclusively pinpoint the factors that influence the incidence of diarrhoea among children under five in Ghana due to the lack of rotavirus vaccination status values in the data set used. Another limitation is that, due to the cross-sectional nature of our data, our findings cannot be interpreted causally. Also, the study is unable to account for seasonal variations in diarrhoea in our analyses.



CHAPTER SIX

6.0 CONCLUSION AND RECOMMENDATION

6.1 INTRODUCTION

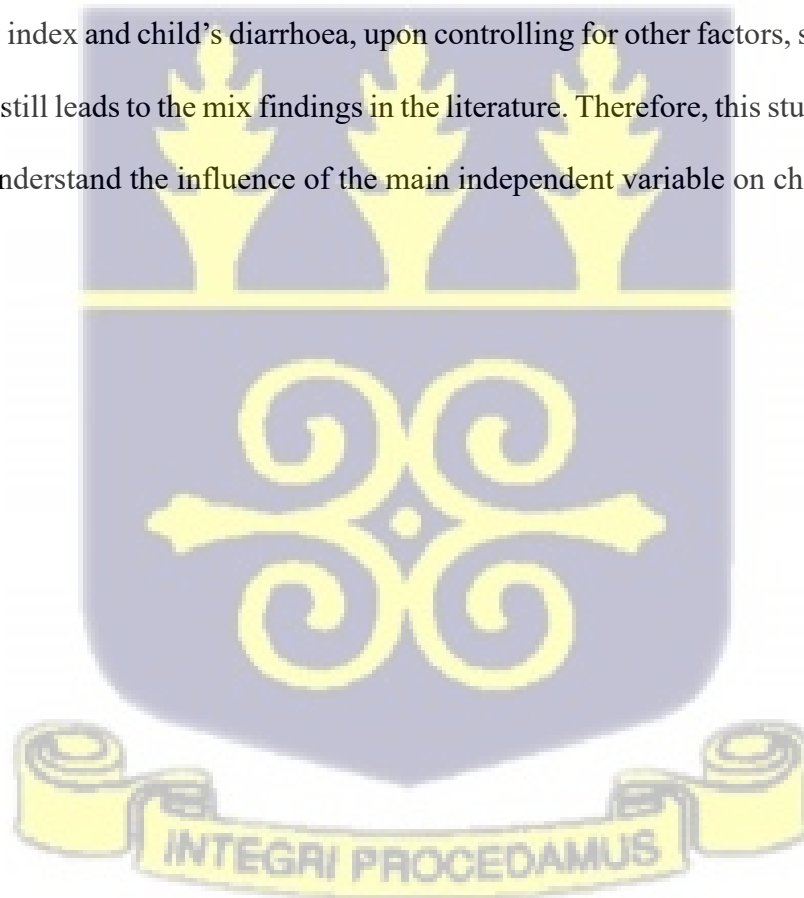
This chapter focuses on concluding on the issue researched, the work carried out, the purpose of the study, summarizing and evaluating the methods employed and the results of the study. Also, this chapter will outline some policy recommendation to be adopted and be implemented to help achieve child health as stipulated in the SDGs goal three.

6.2 CONCLUSIONS

The purpose of this study was to examine the housing conditions and the incidence of diarrhoea among children under the age of five in Ghana. This study found a total prevalence of diarrhoea among children under five years in Ghana to be 17.1%. According to the study, children whose mothers or caregivers wash their hands regularly are less likely to develop diarrhoea. In addition, children who reside in houses made of unimproved materials are more likely to have diarrhoea than those who reside in houses made of improved housing materials. Moreover, children from households that have no separate room for cooking are at increased risk of experiencing diarrhoea. The study also revealed that children of well-educated mothers/caregivers are less likely to become infected with diarrhoea than children of low-educated mothers/caregivers. Children from low socio-economic households were at increased risk of diarrhoea than children from richest household wealth quintile. Last but not least, children who lack access to clean water or adequate sanitation are more likely to get diarrhoea.

6.3 RECOMMENDATIONS

The findings of this study have policy implication and health intervention programs. This study recommends that health authorities in the country intensify health education regarding water, sanitation and hygienic practices. Also, health education should be tailored specifically to women with no form of education. This form of education can take place in the market places, and on the street. Again, district and community health authorities should encourage hand hygiene practices among women specifically those with children below five years. Further the both government, international bodies working in health should sensitized the public and mothers on the need to keep their cooking spaces clean from dirt and infection. Although an association was observed between housing material index and child's diarrhoea, upon controlling for other factors, such was no longer significant. This still leads to the mix findings in the literature. Therefore, this study calls for further studies to help understand the influence of the main independent variable on child's diarrhoea.



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