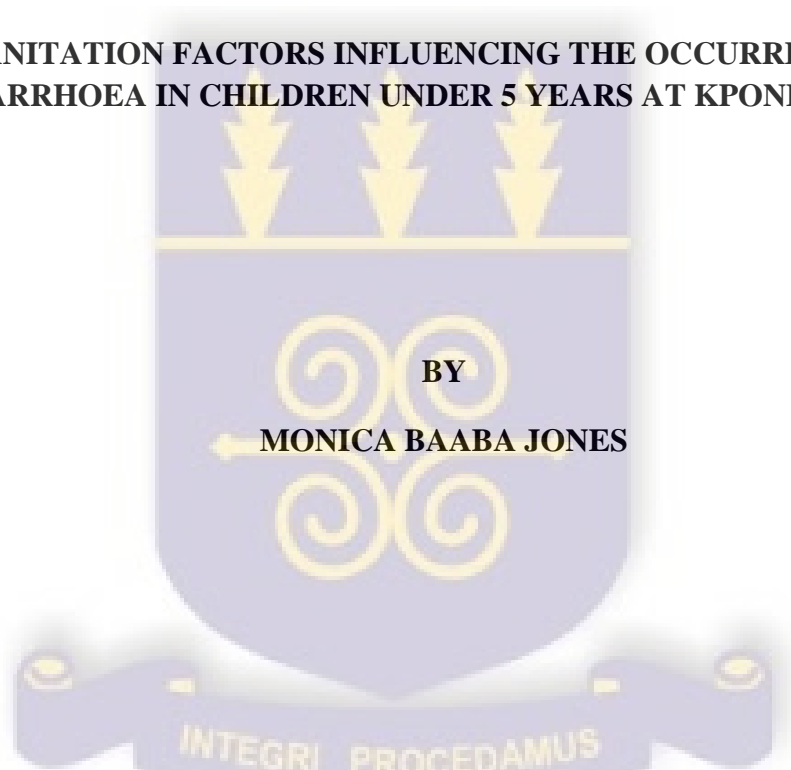


**SCHOOL OF PUBLIC HEALTH  
COLLEGE OF HEALTH SCIENCES  
UNIVERSITY OF GHANA, LEGON**

**SANITATION FACTORS INFLUENCING THE OCCURRENCE OF  
DIARRHOEA IN CHILDREN UNDER 5 YEARS AT KPONE-ON-SEA**

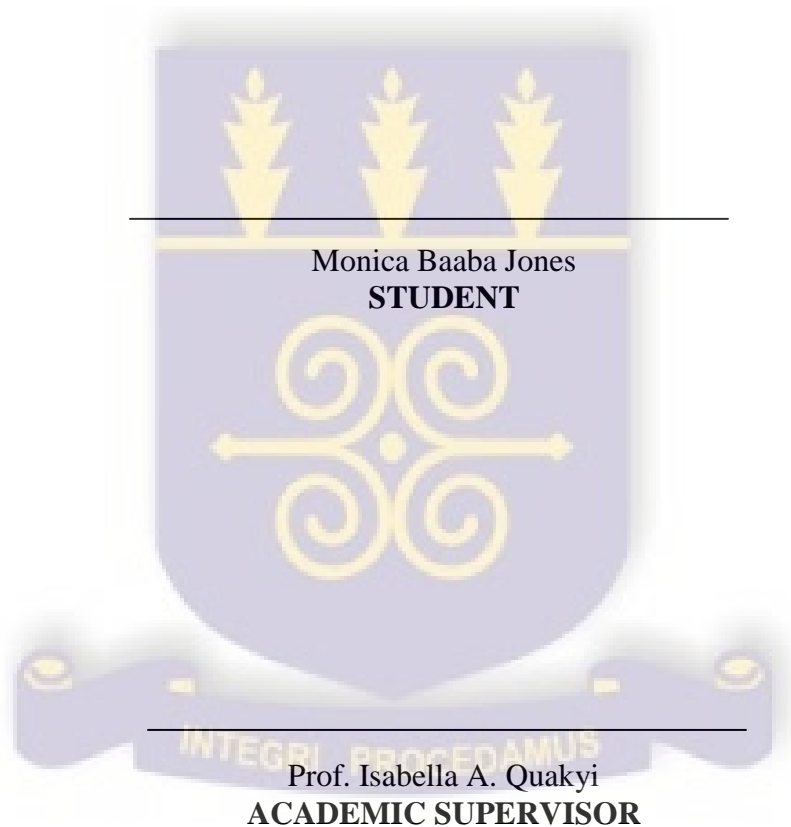


**THIS DISSERTATION IS SUBMITTED TO THE UNIVERSITY OF GHANA,  
LEGON IN PARTIAL FULFILLMENT OF THE REQUIREMENT FOR THE  
AWARD OF MASTER OF PUBLIC HEALTH DEGREE**

**AUGUST, 2010**

## **DECLARATION**

I achieved this work independently under the supervision of Prof. Isabella A. Quakyi. I declare that except for other people's investigations which have been duly acknowledged, this work is the result of my own original research, and this dissertation either in whole or part has not been presented elsewhere for another degree.



## **DEDICATION**

This dissertation is dedicated to my Father in heaven for providing me all the strength I needed to make it this far. To Kobla Nyaletey, you are the best.



## ACKNOWLEDGEMENTS

For your unending blessings I say thank you God. I would like to thank each and everyone who worked with me in the production of this report. Their support, contributions and input have been crucial to the production of this dissertation.

I would start by thanking my academic supervisor Prof. Isabella A. Quakyi whose grasp of research enlightened me and gave me direction. Her suggestions and commitment to ensure my production turned out good were helpful. To my field supervisor Dr Ebenezer Addison I must say I am very grateful. Thanks for your support and advice.

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To members of the Tema Metropolitan Health Management Team for the support I received during field residency.

Any shortcomings in the quality of work however remain my sole responsibility.

## ABSTRACT

Diarrhoea is a global childhood killer, especially of children in developing countries. Eighty eight percent of all cases of diarrhoea worldwide are attributable to drinking water, human excreta disposal and hygiene risk factors. In Ghana, diarrhoea remains of public health concern because it is still a major cause of childhood morbidity and mortality and exposure to the pathogens that cause diarrhoea is frequently related to drinking contaminated water, improper human excreta disposal and inadequate food hygiene practices.

This cross-sectional study was conducted at Kpone-On-Sea to determine the prevalence of diarrhoea among 300 randomly selected children under 5 years at Kpone-On-Sea and describe those aspects of water supply, waste disposal and housing sanitation conditions that influence the occurrence of diarrhoea in these children. The data were collected through questionnaire interviews of caretakers of the selected children, observation for the presence or absence of certain sanitation conditions in caretakers' homes and in-depth interviews.

The results of the study indicate that 26.9% of the children reportedly had diarrhoea during the previous two weeks, with dysentery accounting for 30% of the diarrhoea cases. The main sanitation factors identified in the study were lack a toilet facility at home (OR 2.70, 95% CI 1.01-7.14), drinking water from an unprotected source (OR 2.25, 95% CI 1.19–4.26), and living in a compound with floor material made of earth (OR 2.03, 95% CI 1.12–3.69). Inadequate refuse and waste water disposal, poor housing

sanitation conditions, living in a mud house or wooden structure, use of inadequate quantities and poor quality of water were not significantly associated with diarrhoea.

The findings indicate that under-5 diarrhoea is a problem at Kpone-On-Sea and inadequate water supply, lack of a toilet facility at home and living in a compound with floor material made of earth. Measures should be put in place therefore to improve sanitation services that are likely to result in a reduction of diarrhoea among children.



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## **LIST OF ACRONYMS**

<b>AIDS</b>	Acquired Immunodeficiency Syndrome
<b>DALY</b>	Disability Adjusted Life Years
<b>GDHS</b>	Ghana Demographic and Health Survey
<b>GHC</b>	Ghana Cedi
<b>GIS</b>	Geographical Information System
<b>JHS</b>	Junior High School
<b>ORT</b>	Oral Rehydration Therapy
<b>RCH</b>	Reproductive and Child Health
<b>SHS</b>	Senior High School
<b>SPSS</b>	Statistical Package for Social Scientists
<b>TMHD</b>	Tema Metropolitan Health Directorate
<b>UNICEF</b>	United Nations Children's Emergency Fund
<b>WHO</b>	World Health Organization

## **DEFINITION OF TERMS**

**Sanitation:** the science and practice of maintaining clean, hygienic living conditions free from germs and environmental hazards.

**Sanitation factors:** those aspects of water supply, waste disposal and housing sanitation that facilitate or inhibit the maintenance of clean, hygienic living conditions free from germs and environmental hazards.

**Water supply:** refers to the supply of water for drinking and other purposes. It includes the source of water, the collection and storage of water for purposes such as drinking and cooking.

**Waste disposal:** refers to the management of waste from the point of generation to the point of final disposal. Waste comprises human excreta, solid waste and liquid waste.

**Housing sanitation:** refers to the physical set-up of the caretaker's house, the hygiene conditions of immediate surroundings of the caretaker's house with respect to flies, stagnant waters, exposed waste materials and the presence or absence of livestock.

**Household:** refers to a family usually comprising of a father, mother and children

**Diarrhoea:** refers to the passage of 3 or more loose or liquid stools per day (WHO, 2009).

**Caretaker:** refers to any relative (mother, father, aunt, uncle or grandparent) of the child who is responsible for the health of the child.

## CHAPTER ONE

### 1.0 INTRODUCTION

The World Health Organization (WHO) estimates that environmental risk factors account for 25% of the overall burden of disease, and 30% of that burden falls on children under-five, particularly in developing countries (Briggs, 2003). The fraction of total deaths or Disability-Adjusted Life Years (DALYs) attributable to unsafe water, inadequate waste disposal or insufficient hygiene is more than 20% in children up to 14 years of age (WHO, 2008). Globally, improving water supply, human excreta disposal and hygiene has the potential to prevent at least 9.1% of the disease burden or 6.3% of all deaths (WHO, 2008).

Of the many diseases and hazards that fall within the purview of environmental health, a major one related to child mortality and morbidity is diarrhoeal disease (Kleinau et al, 2004). The term diarrhoea refers to the passage of three or more loose or liquid stools per day (WHO, 2009). It is usually a symptom of gastrointestinal infection spread from person to person through contaminated food or drinking-water or as a result of poor hygiene and includes some more severe diseases, such as cholera, typhoid and dysentery all of which have related faecal–oral transmission pathways (WHO 2008).

## 1.1 Background

A growing body of literature has explored the link between health and sanitation in developing countries with attention particularly focused on diarrhoea because of the mortality and morbidity risks it poses to infants and young children (Abenin et al, 1996). Diarrhoeal diseases are the second most prevalent childhood infections in the world and are a major problem in developing countries, being a leading cause of illness and death in young children. They are so widespread in developing countries that parents often fail to recognize the danger signs. In these countries, 1.5% of newborn deaths in 1993 have been estimated to be caused by diarrhoeal diseases (Bozkurt et al, 2003). Kosek et al, (2003) revealed in a report on the magnitude of the global burden of diarrhoeal disease from studies published from 1992 to 2000 that, diarrhoea accounts for an estimated 21 percent of all deaths of children under five years of age and causes 2.5 million deaths per year.

Children under 2 years of age are especially vulnerable, the highest diarrhoeal mortality rates being found in infants and 1-year-olds, and the highest morbidity rates in children 6-11 months of age. It kills more young children than AIDS, malaria and measles combined (Wardlaw et al, 2009). Children die simply because their bodies are weakened often through rapid loss of fluids and undernourished through lack of food (WHO, 1999). In addition, it contributes to under-nutrition, which in turn affects children's growth and development, and increases their susceptibility to other diseases. Some previous research according to Kauhanen et al, (2009) has even suggested that dehydration in infancy may lead to high blood pressure in later life due to sodium retention.



The etiological factors associated with diarrhoeal disease in children include microbial agents which are usually transmitted through food and water contaminated with human faeces (Kung'u et al., 2002). At least 20 viral, bacterial, and protozoan enteric pathogens, including *Salmonella* spp, *Shigella* spp, *Vibrio cholerae* and rotavirus multiply in the human gut, exit in excreta and transit through the environment, causing diarrhoea in new hosts (Curtis & Cairncross, 2003). Its causes may therefore involve the individual household, the public sector as a provider of private goods and services - such as sanitation services - and as a provider of public goods such as pest control programs or improved surface water quality (Abenin et al., 1996).

A WHO (2008) report estimated that 88 per cent of cases of diarrhoea worldwide are attributable to unsafe water, inadequate human excreta disposal or insufficient hygiene. These cases result in 1.5 million deaths each year, most being the deaths of children. Water supply, waste disposal and hygiene are often collectively referred to as the composite risk factor that has the greatest influence on the occurrence of diarrhoea. Because diarrhoeal diseases are of faecal origin, interventions that prevent faecal material entering the domestic environment of the susceptible child are likely to be of greatest significance for public health (Curtis et al., 2005). The key primary barriers to the transmission of enteric pathogens are safe stool disposal and adequate hand washing, especially after contact with faecal material during anal cleansing of adults and children (Humphrey, 2009). Hands serve as vectors, transmitting pathogens to foodstuffs and drinks and to the mouths of susceptible hosts (Curtis & Cairncross, 2003). Studies have shown that hygiene improvement interventions such as improved water, human excreta

disposal and hygiene have resulted in a 30%–50% reduction in the burden of diarrhoeal diseases (Kleinau et al., 2004). Environmental interventions, including water supply and excreta disposal improvements, have therefore been advocated by the World Health Organization (WHO) as part of a multifaceted strategy for diarrhoea control.

In Ghana, diarrhoea accounts for 84,000 deaths annually with 25 percent being children under five years (GNA, 2003). Although mortality and morbidity rates have been declining considerably due to improved health services and extensive coverage, as well as a successful campaign on Oral Rehydration Therapy (ORT), dehydration caused by severe diarrhoea is still a major cause of morbidity and mortality among children (GDHS, 2008). Factors such as age of the child, quality and quantity of water, availability of toilet facilities, housing conditions, place of residence, feeding practices, and the general level of hygiene in the home affects exposure to diarrhoea pathogens especially in children under 5 years old (Boadi & Kuitenun, 2005; GDHS, 2008). According to a 2006 Country Information Sheet from Water Aid, sanitation coverage remains fairly low, with only 44% of the rural population and 61% of the urban population having access to safe water while fewer still have access to human excreta disposal facilities– 11% of the rural population and 40% of the urban population. Diarrhoea accounts for around 25% of deaths of children under 5, highlighting an urgent need to raise awareness of the need for improved sanitation and hygiene (WEDC, 2005).

Kpone-On-Sea is a coastal fishing community in the Kpone sub-district of the Tema Metropolis, Ghana. According to the Tema Metropolitan Health Directorate (TMHD) annual report 2009, water supply in the rural and the new-developing communities and slum areas is inadequate. Inhabitants of these settlements buy water by the bucket from

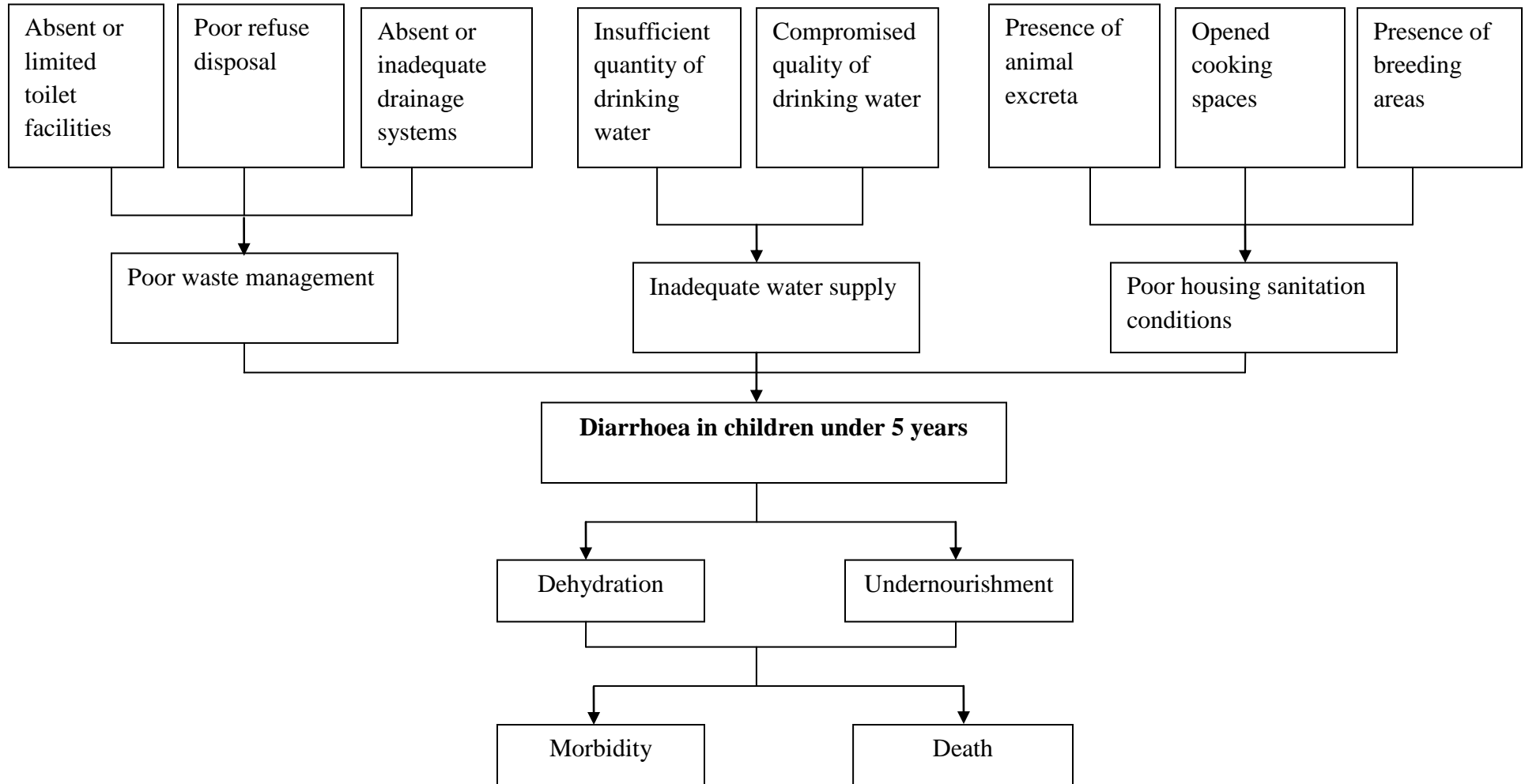
storage tanks, with possible risk of contamination with cholera and typhoid organisms. The report also revealed that waste disposal is a major public health-related problem in the metropolis and that there is a general poor attitude to waste disposal and hygiene issues among the population. In addition, in the poorer parts of urban areas, as well as in the rural areas, toilet facilities are very limited. In some areas, especially the slums, where many houses lack toilets, the inhabitants use the available open spaces and the beaches as toilets (the so-called 'free range'), a practice which has resulted in a heavily contaminated environment that poses grave risks for enteric diseases. Faeco-oral diseases such as typhoid, dysentery and childhood diarrhoeas thus, occur commonly in the rural communities and slum areas in addition to other key health related problems that the whole metropolis suffers.

Though many researchers have studied the effects of improvement of water supply, waste disposal and hygiene on diarrhoeal diseases occurrence, available evidence indicates that the impact of each may vary widely according to local circumstances (WHO, 2008). Prioritizing of specific interventions for the prevention and control of diarrhoea should therefore be based on evidence-based research on local conditions - such as Kpone-On-Sea -to help reduce the occurrence of diarrhoea which is a step in line with the commitment to achieving Millennium Development Goal 4 of reducing under-five mortality by two-thirds by 2015.

## **1.2 Problem Analysis**

Figure 1.1 examines the main sanitation factors (causes) influencing the occurrence of diarrhoea in children under 5 and highlights the main effects of diarrhoea. The various aspects of inadequate sanitation have been classified into inadequate water supply, improper waste management and unhygienic housing sanitation conditions that directly or indirectly influence the occurrence of diarrhoeal diseases. Insufficient quantities and compromised quality of water result in inadequacy of water supply. Improper waste management results from absent or limited toilet facilities, absent or inadequate drainage systems and poor refuse management. The presence of animals, fly breeding areas and open cooking areas usually render housing sanitation conditions inadequate or unhygienic. However, hygiene behaviours have been found to play a major role in the occurrence of diarrhoea as they facilitate or inhibit the transmission of diarrhoea-causing pathogens, sometimes regardless of the sanitation conditions present.

**Fig 1.1 Problem analysis of sanitation factors influencing the occurrence of diarrhoea in children under 5 years at Kpone-On-Sea**



### **1.3 Conceptual framework**

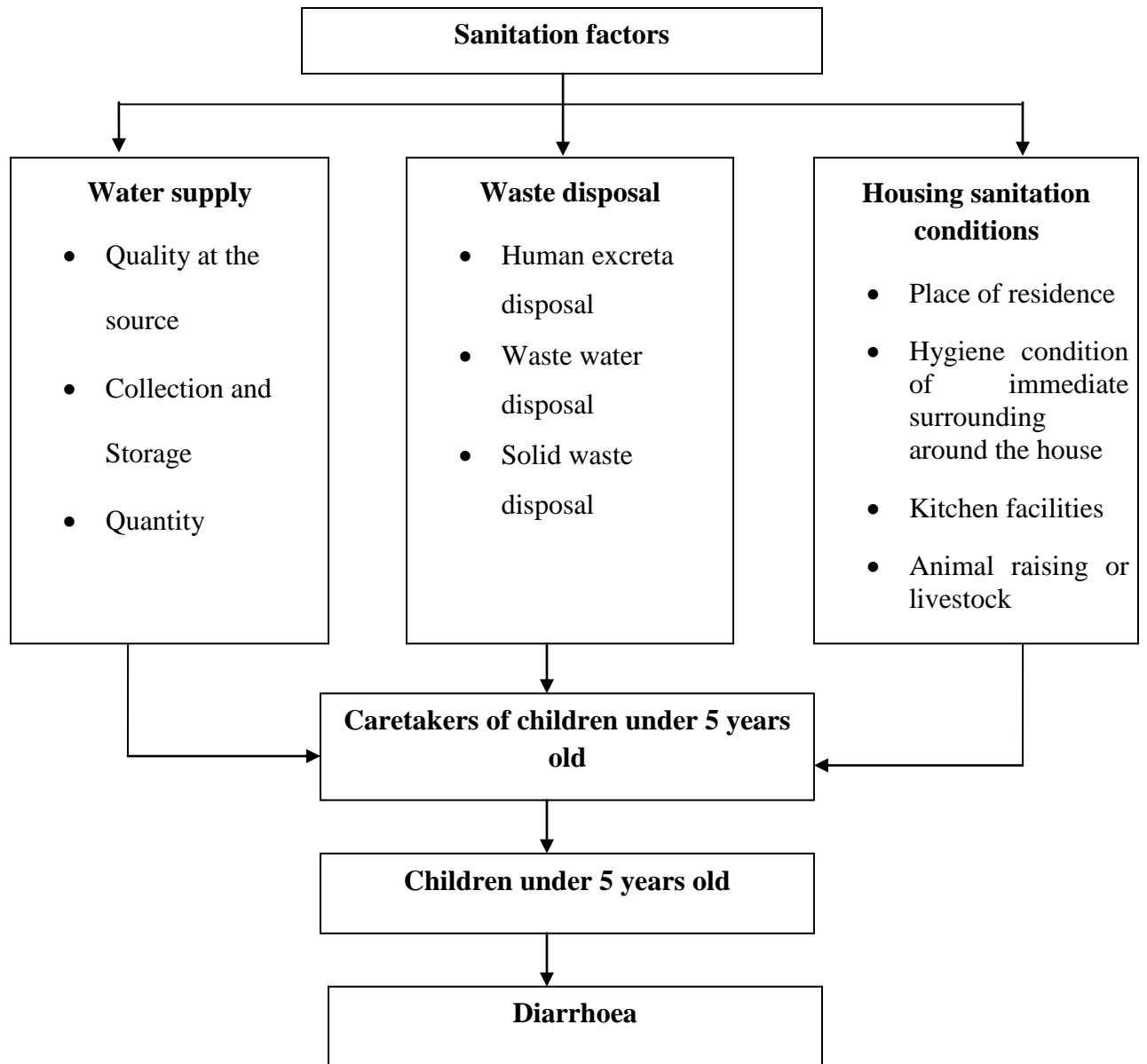
Figure 1.2 conceptualizes the problem of childhood diarrhoeal disease in relation to sanitation conditions (prevailing in caretakers' homes) that predispose children to diarrhoea. This model recognizes that the occurrence of diarrhoeal diseases in children under 5 years is influenced by a variety of complex and interrelated aspects of sanitation. It assigns these conditions into three categories namely: water supply, waste disposal and housing sanitation conditions.

**Water Supply:** Inadequate quantities and compromised quality of drinking water cause preventable diseases - primarily diarrhoea - each year. The quality of water in the household is primarily a function of quality at the source. This category considers the quality at the source, collection/storage and quantity of water available to households.

**Waste disposal:** Disposing of human excreta (faeces and urine), household solid and liquid waste safely is as essential as a safe water supply in preventing diarrhoeal diseases. Under the category of waste disposal in the model human excreta, household waste water (grey water) and solid waste (refuse) disposal are considered.

**Housing sanitation conditions:** This category deals with the hygiene conditions of the immediate surrounding around the house of the caretaker of the child under 5, kitchen facilities and animal raising or livestock. Good domestic and personal hygiene behaviours are facilitated or inhibited by the presence of adequate housing conditions such as mentioned above. Good hygiene can break the chain of transmission of diarrhoea-causing pathogens, thereby preventing or reducing the incidence of diarrhoea.

**Fig 1.2: Conceptual framework for the study of sanitation factors influencing the occurrence of diarrhoeal diseases in children under 5 years at Kpone-On-Sea**



#### **1.4 Statement of the problem**

Diarrhoea is a global problem and has been estimated to account for 25-75 per cent of all childhood illnesses in Africa (Boadi & Kuitunen, 2005) with highest prevalence among poor households living under conditions of poor personal and domestic hygiene (McGranahan et al., 1999). The distribution of causes of death in children under 5 according to a mortality fact sheet (WHO, 2006) indicate that diarrhoeal diseases remain of public health concern in Ghana, being the third leading cause of deaths between 2000 and 2003. Furthermore, the recently conducted 2008 GDHS supports these findings as it indicates that dehydration caused by severe diarrhoea is still a major cause of morbidity and mortality among young children in Ghana and exposure to these diarrhoea-causing agents was frequently related to the use of contaminated water and to unhygienic practices in food preparation and disposal of excreta. One can see here a clear indication of the role of sanitation on the occurrence of diarrhoea in Ghana. However, information on exactly which of these numerous factors influence the occurrence of diarrhoeal diseases in specific areas of the country is inadequate.

The Tema Metropolitan Health Directorate (TMHD) annual report for 2009 revealed that the rural, the newly-developing communities and slum areas of the metropolis are the most affected by the major public health-related problem of inadequate sanitation. According to the report, water supply is inadequate - inhabitants of these settlements buy water by the bucket from storage tanks, with possible risk of contamination with cholera and typhoid organisms. In addition drainage gutters are inadequate or absent and toilet facilities are very limited. Inhabitants use the available open spaces and the beaches as



toilets (the so-called ‘free range’). Consequently, diarrhoeal disease is an additional health challenge these deprived communities are faced with in the metropolis.

Kpone-On-Sea, a coastal fishing village in the Kpone sub-district of the Tema Metropolis, Ghana, is one of such areas faced with the problems of inadequate sanitation (inadequate quantities of potable water, lack of toilet facilities and poor refuse disposal) and childhood diarrhoeal diseases (Personal communication, Principal Physician of Kpone Health Centre). However, information on the exact burden of diarrhoeal diseases in children under 5 years in this area is inadequate and the sanitation factors that may significantly influence the occurrence of the disease among children in this community are unknown. This research therefore seeks to provide empirical evidence of the magnitude of the problem and the contribution of sanitation to diarrhoea for the implementation of appropriate interventions that would impact on diarrhoea reduction in the community thereby impacting on childhood morbidity and mortality.

### **1.5 Justification**

Many studies have established that diarrhoeal diseases are more frequent in places where water supplies were contaminated with faeces, where there was no habit of washing hands, especially before meals, where individual hygiene was not sufficient and where supplementary feeding was not hygienic. It is worth noting however, that water supply, waste disposal and hygiene interventions interact with one another and available evidence indicates that the impact of each may vary widely according to local circumstances. There is the need therefore to identify which of these risk factors greatly influence the occurrence of diarrhoeal diseases, especially in children, in specific areas for the application of the most cost-effective public health intervention programmes.

Kpone-On-Sea is one of the field sites developed by the School of Public Health where research on malaria, adolescent health and non-communicable diseases are currently ongoing. The contribution of the burden of sanitation-related diarrhoeal diseases to the total burden of disease in this community is not well established. This study will provide information on which sanitation factors greatly influence the occurrence of diarrhoea and so serve as basis for future plans, action and interventions to address the problem of childhood diarrhoea in Kpone-On-Sea.

## **1.6 Study Objectives**

### **1.6.1 Main Objective**

To determine the prevalence of diarrhoea and describe the sanitation factors that influence its occurrence in children under 5 years at Kpone-On-Sea.

### **1.6.2 Specific Objectives**

1. To determine the prevalence of diarrhoea among children under 5 years at Kpone-On-Sea
2. To assess water supply, waste disposal and housing sanitation conditions in the homes of caretakers of children under five years at Kpone-On-Sea
3. To determine an association between sanitation factors and the occurrence of diarrhoea in children under 5 years at Kpone-On-Sea

## **CHAPTER TWO**

### **2.0 LITERATURE REVIEW**

The previous chapter provided a background on the issue of diarrhoea and the contribution of inadequate sanitation to its occurrence. It also focused on the study location, its demography and problem of diarrhoea in children under 5 years. This chapter seeks to provide a review of available literature pertaining to the problem of childhood diarrhoea. Some of the main findings of reviewed literature suggest that access to water and toilet facilities, hygiene practices and fly infestations strongly affect the occurrence of diarrhoea, a global killer of children under 5 years. Moreover, child factors, household economic status and education of the caretaker or mother of a child under 5 are also significant determinants of diarrhoea and their effects cannot be ruled out. The term sanitation in the reviewed literature referred strictly to human excreta disposal. This term has however been replaced with human excreta disposal for the purpose of this study.

### **2.1 Diarrhoea**

#### **2.1.1 Definition of diarrhoea**

Diarrhoea is characterized by the passage of 3 or more loose or liquid stools per day (WHO, 2009). Acute diarrhoea is a major cause of childhood morbidity and mortality in sub-Saharan Africa (Reither et al., 2007) and comes in three main forms, all of which are potentially life-threatening and require different treatment courses:

*Acute watery diarrhoea* lasts several hours or days, can be rapidly dehydrating with stool losses of 250 milliliters per kilogram per day or more and is usually due to rotavirus, enterotoxigenic *E. coli*, or *V. cholerae* (the cause of cholera), and it is most dangerous in the very young (Keusch et al., 2006).

*Acute bloody diarrhoea* which is also called dysentery defined as diarrhoea with visible or microscopic blood in the stool is associated with intestinal damage and nutritional deterioration, often with secondary sepsis. The most important cause of acute dysentery is *Shigella*; other causes are *Campylobacter jejuni* and, infrequently enteroinvasive *E. coli* or *Salmonella* (Keusch et al., 2006).

*Persistent diarrhoea* lasts for 14 days or longer and is typically associated with malnutrition, either preceding or resulting from the illness itself. It often begins as either acute or dysentery and once present in the guts is difficult to remove. Significant weight loss is expected with the diarrhoea looking like the food ingested. An example of this is Cryptosporidiosis (WHO, 1998; Labay , 2007).

### **2.1.2 Etiology and Transmission of diarrhoea**

Diarrhoea is caused by infectious organisms, including viruses, bacteria, protozoa, and helminthes. However, just a handful of these organisms are responsible for most acute cases of childhood diarrhoea (WHO, 1999). At least 20 viral, bacterial, and protozoan enteric pathogens, including *Salmonella* spp, *Shigella* spp, *Vibrio cholerae*, and rotavirus multiply in the human gut, exit in excreta and transit through the environment, causing diarrhoea in new hosts (Curtis & Cairncross, 2003). Rotavirus is the leading cause of

acute diarrhoea and is responsible for about 40 per cent of all hospital admissions due to diarrhoea among children under five worldwide (Black et al., 2003).

Most pathogens that cause diarrhoea share a similar mode of transmission - from the stool of one person to the mouth of another, commonly known as faecal-oral transmission. Hence, the infectious agents that cause diarrhoea are usually spread by the faecal-oral route, which includes the ingestion of faecally contaminated water or food, person-to-person transmission, and direct contact with infected faeces. Underlying reasons for the spread of diarrhoeal diseases are found in poor hygiene and human excreta disposal, limited access to safe drinking water as well as in inadequate education of health care providers and recipients (Curtis et al., 2005; Thapar & Sanderson, 2004).

## **2.2 Burden of diarrhoeal diseases**

Diarrhoea is a serious global public health problem. Every year there are about two (2) billion cases of diarrhoeal disease worldwide. The World Health Organization (WHO) estimates that over 2.2 million deaths due to diarrhoeal infections occur annually, especially among children less than five years of age and the yearly global diarrhoeal disease burden is estimated at 99.2 million Disability Adjusted Life Years (DALYs) lost through incapacitation and premature deaths, mainly in low- and middle income countries (Ejemot et al., 2008).

According to WHO Global Burden of Disease (GBD) 2002 estimates, diarrhoea accounts for nearly 1.6 million deaths or 15% of under-five mortality each year in developing countries (WHO, 2003). Based on a June 2003 Lancet article, the number may be as high

as 2.3 million (Black et al., 2003). Though the mortality rate for children under five suffering from acute diarrhoea has fallen from 4.5 million deaths annually in 1979 to 1.6 million deaths in 2002, acute diarrhoea continues to exact a high toll on children in developing countries (WHO/UNICEF, 2004). The WHO Child Health Epidemiology Reference Group estimates that 16% of deaths in African children younger than five years are directly attributable to diarrhoeal diseases (Bryce et al., 2005). More than one billion episodes of diarrhoea occur every year among children under five years of age causing approximately 2.5 million deaths (Kosek et al., 2003; O’Ryan et al., 2005).

In children under five years old, diarrhoeal disease is the second leading cause of death – second only to pneumonia. Nearly one in every five child deaths—around 1.5 million a year—is due to diarrhoea, which kills more children than AIDS, malaria, and measles combined (Wardlaw et al., 2009). Out of the 1.5 million children killed by diarrhoeal disease in 2004, 80% were under two years old. In developing countries, children under three years old experience on average three episodes of diarrhoea every year. Each episode deprives the child of the nutrition necessary for growth. As a result, diarrhoea is a major cause of malnutrition, and malnourished children are more likely to fall ill from diarrhoea (WHO, 2009). Just under 9 million children aged under 5 years died in 2008 and nearly 40% of these deaths were due to two diseases: pneumonia and diarrhoea (You et al., 2009).

Despite different methods and sources of information, each successive review of the diarrhoea burden over the past decades has demonstrated relatively stable morbidity despite the decline in mortality.

In Ghana, diarrhoea has been identified as the second most common health problem treated in outpatient clinics (Osumanu, 2007). Statistics from the Ministry of Health indicate that diarrhoea accounts for 84 000 deaths annually in Ghana, with 25 per cent being children under 5 years (Ghana News Agency, 2003). Diarrhoea thus poses a major threat to child health and survival in Ghana. In the 2008 GHDS report dehydration caused by severe diarrhoea was mentioned to be a major cause of morbidity and mortality among young children in Ghana and that exposure to diarrhoea-causing agents is frequently related to the use of contaminated water and to unhygienic practices in food preparation and disposal of excreta. One in five children had diarrhoea during the survey period; 3 percent had diarrhoea with blood, a symptom of dysentery (GDHS, 2008). A study conducted by Boadi & Kuitenen, (2005) in Accra, found a 2-week prevalence of 19.2% whereas dysentery accounted for 29.8% of the diarrhoea cases.

### **2.3 Sanitation factors influencing diarrhoea in children under 5**

A strong relationship exists between poverty, an unhygienic environment, and the number and severity of diarrhoeal episodes especially for children under five. Poverty is associated with poor housing, crowding, dirty floors, lack of access to sufficient clean water or to insanitary disposal of faecal waste, cohabitation with domestic animals that may carry human pathogens, and a lack of refrigerated storage for food—all of which increase the frequency of diarrhoea. Poor water supply and excreta disposal have a high health toll, whereas improving water and human excreta disposal brings valuable benefits to both social and economic development. Improvements in water supply and human



excreta disposal have been historically documented to benefit health and improve life expectancy. Cholera, a worldwide problem for instance can be prevented by ensuring that everyone has access to safe drinking water, adequate excreta disposal systems and good hygiene behaviours (WHO/UNICEF, 2000).

### **2.3.1 Water supply**

Lack of improved domestic water supply leads to disease through two principal transmission routes namely waterborne and water-washed disease transmission. Waterborne diseases are one of the major killers of children in lower-income countries. According to the World Bank, three million children die every year from cholera and other water-borne diarrhoeal disorders (World Bank, 2002). Adequate quantities of safe water for consumption and its use to promote hygiene are complementary measures for protecting health. The quantity of water people use depends upon their ease of access to it. Diarrhoea is the most important public health problem affected by water and can be both waterborne and water-washed. Studies indicate that methods of drawing water from household water containers and covering status of water storage facilities determine the outcome of diarrhea.

A case-control study of the effect of environmental sanitation on diarrhoea morbidity in a rural district in Malawi demonstrated that the quality of water in the household was primarily a function of quality at the source. The only statistically significant association with household water quality was the source of the water ( $p < 0.01$ ) (Young & Briscoe., 1987). Boadi and Kuitunen (2005) in their cross sectional study of the determinants of

childhood diarrhoea in Accra, Ghana also found that the household source of drinking water showed a negative association with the incidence of childhood diarrhoea ( $r = -0.34$ ,  $p < 0.0001$ ). Lack of or inadequate access to potable water was associated with high incidence of diarrhoea. Childhood diarrhoea decreased with a standpipe and private indoor pipe and all cases associated with lack of access to potable water were poor children.

### **2.3.2 Waste disposal**

Waste disposal facilities interrupt the transmission of much faecal–oral disease at its most important source by preventing human faecal contamination of water and soil. Epidemiological evidence suggests that excreta disposal is at least as effective in preventing disease as improved water supply. Adults often think of human excreta disposal in adult terms, but the safe disposal of children’s faeces is of critical importance. Children are the main victims of diarrhoea and other faecal–oral disease, and also the most likely source of infection (WHO-UNICEF 2006).

The effect of improved environmental sanitation on the risk of diarrhoeal disease had been estimated through crude and multivariate logistic regression analyses in a case-control study conducted in a rural district in Malawi. Improved human excreta disposal appeared to have reduced diarrhoeal incidence, with an odds ratio estimate of 0.77 ( $\chi^2 = 2.09$ ,  $p = 0.15$ ) (Young & Briscoe, 1987). Boadi and Kuitunen (2005) demonstrated that the availability of and access to a toilet facility were inversely related with the incidence of diarrhoea ( $r = -0.29$ ,  $p < 0.0001$ ). The incidence of diarrhoea was also affected by

neighborhood open defecation where a significant portion of diarrhoea cases lived in homes where the mothers reported of outdoor defecation in the neighborhood. Households who shared a toilet facility with more than five other households were also more likely to have high incidence of childhood diarrhoea ( $\chi^2 = 41.73$ , 4df,  $p < 0.0001$ ). High sharing of toilet was also found to be associated with dysentery which affected mainly children from poor households.

A case-control study conducted by Heller et al., (2009) on environmental sanitation conditions and impact on health in Brazil revealed a significant association between waste water disposal and diarrhoea. Disposal of waste water by any means other than public collection systems posed a risk for diarrhoea (RR=1.97; CI 1.63-2.37). Yongsu (2009) also found similar results in a study on waste water disposal in urban Yaounde, Cameroon.

### **2.3.3 Housing sanitation**

Poor housing sanitation conditions is a major factor that accounts for high prevalence of pests such as flies, mosquitoes and cockroaches which pose tremendous health hazards (Songsore et al, 2006). Despite strong circumstantial evidence that flies are vectors of diarrhoeal diseases, no convincing studies of the impact of fly control on diarrhoea incidence in developing countries have been reported (Chavasse et al., 1999).

Bozkurt et al., (2003) have demonstrated in a cohort study that the annual mean incidence of diarrhoeal disease episodes was higher in children with poor housing conditions ( $1.48 \pm 0.12$ ) compared with children with good housing conditions ( $0.76 \pm 0.07$ ). Boadi

and Kuitunen (2005) again demonstrated in their study that the presence of houseflies in the household kitchen during cooking was positively correlated with diarrhoea morbidity ( $r = 0.36$ ,  $p < 0.0001$ ). The risk of childhood diarrhoea increases with the presence of flies always in the kitchen during cooking. In a study on diarrhoeal morbidity among young children in Eritrea, conducted by Woldemicael (2001), a significant association was seen between living in houses with non-dirt (concrete or cement) floors and diarrhoea. Children living in houses with non-dirt floors were 43% less likely to develop diarrhoea than those living in houses with dirt (earth, sand, dung) floors ( $OR=0.57$ ).

## **2.4 Major predictors of diarrhoea in children under 5 years**

Many studies have established that child factors such as birth weight, breastfeeding status at first six months and child age significantly affect the occurrence of diarrhoea in children under 5 years. Likewise certain socio-demographic factors such as education and economic status of caretakers influence the occurrence of diarrhoea. Finally, behavioural factors such as hand washing before feeding a child and after visiting the toilet, disposal of child faeces affect the occurrence of diarrhoea. Presented below are the findings from studies and other relevant literature on the selected risk factors that significantly contribute to the occurrence of diarrhoea.

### **2.4.1 Socio-demographic factors**

A study conducted in the Accra Metropolitan area in Ghana on the determinants of childhood diarrhoeal morbidity, indicate that the incidence of childhood diarrhoea was negatively correlated with the household economic status ( $r = -0.26$ ,  $p < 0.05$ ) and the

mother's education ( $r = -0.33$ ,  $p < 0.0001$ ). Maternal education influenced hand washing before cooking ( $p < 0.0001$ , 95% CI) and after using the toilet ( $p = 0.013$ , 95% CI) (Boadi & Kuitunen, 2005). In a study by Bozkurt et al., (2003) the annual mean incidence of diarrhoeal disease episodes was found to be higher in children aged between 6 and 11 months ( $1.51 \pm 0.18$ ), whose father graduated from primary school or lower ( $1.34 \pm 0.09$ ), in children living in a two- or three-storey house ( $1.33 \pm 0.10$ ), whose mothers had no counseling on diarrhoeal diseases and their impact on health of children ( $1.32 \pm 0.11$ ) and with parents having no habit of washing their hands before taking care of the child ( $2.00 \pm 0.33$ ). El-Gilany et al., 2005 in their study on the epidemiology of diarrhoeal diseases among children under 5 years in Dakahlia, Egypt found that both point and period prevalence rates of diarrhoea were significantly higher among children of mothers who did not go out to work and whose mothers were less than 25 years old.

#### **2.4.2 Child Factors**

El-Gilany et al., 2005 in the same study conducted on the epidemiology of diarrhoeal diseases among children under age 5 years in Dakahlia, Egypt found that both period and point prevalence rates of diarrhoea decreased significantly with increased age apart from the first 6 months of age. These rates were highest in the age group of 6 months to less than 12 months and were lowest among children aged 48 months to less than 60 months. Diarrhoeal prevalence rates were also significantly higher among higher birth order children compared with lower birth order children. A similar age variation in diarrhoea occurrence was reported by Ahmed et al., 2008 in a cross-sectional study in Kashmir,

India where the 6 – 11 months age group showed higher prevalence of diarrhoea in all seasons. However, the 2008 GDHS found that diarrhoea prevalence increases with age and peaks at 12-23 months (33 percent), then declines at older ages. Birth order was also associated with risk of diarrhea (OR, 0.85 [0.74 to 0.97];  $p = 0.018$ ), with the late born scoring the lower risk for diarrhoea. There were no significant differences concerning the risk of diarrhoea between children receiving breast milk and those who were being weaned. There was not a significant relationship between the risk of having a case of diarrhoea and birth weight (OR, 0.85 [0.56 to 1.29];  $p = 0.46$ ) (Gascon et al., 2000). Studies on the role of breastfeeding on the prevention of infant mortality found that compared with breastfed infants, infants who are not breastfed in the first 6 months of life have a six fold greater risk of mortality due to diarrhoea. In addition infants who are not breastfed from 6-11 months of age have a two-fold greater risk of mortality due to diarrhoea (Sachdev et al., 1991; WHO, 2006).

### **2.4.3 Behavioural factors**

A study to evaluate the effects of interventions to promote hand washing on diarrhoeal episodes in children and adults found that hand washing interventions are efficacious in reducing diarrhoeal episodes by about 30% and should be promoted (Ejemot., 2008). A cohort study of childhood diarrhoea and observed hygiene behaviour in Salvador, Brazil demonstrate that among households that had adequate excreta disposal, there were 2.2 times more children with positive scores than negative scores but only 1.2 times more in households that did not. Excreta disposal behaviors were independently associated with

diarrhoea (Strina et al., 2003). There is a negative correlation between the mother's hygiene practices of hand washing with water or soap before preparing meals ( $r = -0.39$ ,  $p < 0.0001$ ), and after using the toilet ( $r = -0.43$ ,  $p < 0.0001$ ), and the incidence of diarrhea. (Boadi & Kuitunen, 2005)

## **2.5 Summary**

The epidemiological pathway of diarrhoeal diseases could be summarized in terms of sources or breeding places to carriers and receivers. However, this complex and interrelated pathway is influenced further by socioeconomic, behavioural and child factors that either facilitate or inhibit the transmission of diarrhoea-causing pathogens and/or the severity of the disease. To act effectively in preventing disease and promoting health, it is important to know not only how much disease is caused by factors related to water, waste disposal and hygiene, but also how effectively changes in their management can improve health. According to a WHO report on water, excreta disposal and hygiene links to health, improved water supply reduces diarrhoea morbidity by 21% while improved excreta disposal reduces diarrhoea morbidity by 37.5%. The simple act of washing hands at critical times can reduce the number of diarrhoeal cases by up to 35%. Additional improvement of drinking-water quality, such as point of use disinfection, would lead to a reduction of diarrhoea episodes of 45% (WHO, 2004).

## **CHAPTER THREE**

### **3.0 METHODS**

The study adopted the use of both quantitative and qualitative data collection techniques. Data collection was done with the use of structured questionnaires, observational checklists and in-depth interview guides. Quantitative data was entered into the computer and analysed with SPSS version 16 software whereas qualitative data was manually analysed under themes and incorporated into the results.

#### **3.1 Study Design**

This was a cross sectional study aimed at determining the prevalence of diarrhoea (as stated by the caretaker, that took place from the previous two weeks up to the actual date of interview) and describe the sanitation factors that may influence its occurrence in children less than 5 years old at Kpone-On-Sea.

#### **3.2 Study period and location**

The study was conducted from May 25, 2010 to June 13, 2010 at Kpone-On-Sea, a GIS mapped study site developed by the School of Public Health (Quakyi et al., 2004). It is one of the twelve communities that make up the Kpone sub district in the Tema Metropolis, Greater Accra Region, Ghana. It is a coastal fishing community surrounded by shrub land, on the east by Prampram, on the west by Tema, on the north by the Industrial Free Zone and on the south about 139m from the Gulf of Guinea. It stands at an altitude of 50 and 100m above sea level and has an equatorial climate. Temperatures range from 24.4°C – 27.8°C, a mean of 26.1°C with an average relative humidity index ranging from 78% to 85%. The community is divided into four sectors with varying



environmental characteristics and population size. The land formation and the drainage patterns of the 4 sectors of the community is such that all water from there drains into a stream that lies on the outskirts of the Kpone township. A lagoon also on the outskirts of the community divides it from Prampram. Kpone has limited pools of stagnant water. Majority of the residents (80%) are of Ga, Ga-Adangbe ethnic group. Kpone is primarily a fishing community but the majority of residents are involved in farming. A centrally located clinic in the Kpone town founded in 1992 by the Rotary Club of Tema is the main health facility providing health care services to the people.

Kpone-On-Sea was selected for this study because of its problem of inadequate sanitation and high diarrhoeal disease occurrence in children under 5 years old, revealed during a conversation with the principal physician of the Kpone Health Centre.

### **3.3 Variables and functional definition**

1. Diarrhoeal disease occurrence in children under 5 years: refers to children under 5 years reported by their caretakers to have had diarrhoea on any day from the previous two weeks up to the actual date of interview.

2. Practice of the caretaker of child under 5 years: defined as tasks performed by the caretaker that influences the occurrence of diarrhoea such as hand washing, food storage, feeding and child's stool disposal.

3. Method of Refuse disposal:

Sanitary if refuse is thrown in a garbage bin, buried or burnt

Unsanitary if refuse is thrown around the house making it accessible to flies

4. Source of drinking water:

Improved – water from an indoor pipe, community standpipe or rain water

Unimproved – water from unprotected wells, rivers or stream

5. Waste water disposal:

Sanitary – waste water is poured in a drainage system at home

Unsanitary – waste water is poured around the house or in an open gutter

6. Method of collecting and storing water:

Hygienic – Water is both collected with and stored in a covered container

Unhygienic – Drinking water is either collected or stored in an open container

7. Risk of contamination of source of drinking water

Absent – No potential risk of microbial contamination was observed around the source

Present – Some risk of microbial contamination such as the presence of animals around the source was observed

8. Quantity of water: Ascertained by the use of a 20 litre gallon or bucket

Adequate – household uses 20 litres or more of water daily per head

Inadequate – household uses less than 20 litres of water daily per head

9. Hygiene conditions of surrounding: Assessed by the use of a checklist which recorded the presence of conditions such as flies, stagnant waters, opened kitchen spaces

Good – checklist scores add up to less than 3

Poor – checklist scores add up to 3 or more

10. Child factors: this includes any characteristic such as age, birth weight, history of breastfeeding at first six months of life of the child that predisposes them to diarrhoea

11. Socio-demographic factors of caretaker: includes age, educational level and employment of caretaker

12. Unprotected source of drinking water: refers to an unprotected well, stream, river or any large water reservoir or storage tank that is not covered

13. Type of floor material of the surroundings: this is classified into earth (soil) or other (concrete or cement).

### **3.4 Study population**

The study population comprised all children less than 5 years of age (0 to 59 months) residing at Kpone-On-Sea. Caretakers however provided responses to questionnaires on behalf of the selected children.

### **3.5 Sampling**

A total of 300 children under age 5 with their respective caretakers were selected for the quantitative data whereas one (1) nursing officer and the chief environmental health officer at Kpone-On-Sea were selected for in-depth interviews.

#### **3.5.1. Sample size calculation for questionnaire interviews**

According to the TMHD annual report for 2009 the population of the Tema Metropolis grows at an estimated 4.4% annually. Based on this information the projected population of children under 5 years at Kpone-On-Sea for the year 2010 was approximately 1,400. The GDHS (2008) reported that the percentage of children under age five in rural Ghana who had diarrhoea in the two weeks preceding the survey was 21.3. This was considered

as the expected frequency of diarrhoea in children less than 5 years at Kpone. Considering a margin of error of 5%, the worst acceptable frequency used was 16.3. All of this information was fed into the STATCALC function of EPI-INFO version 3.3 software and a size of 219 at 95 percent confidence level was arrived at. Hence, a minimum of 219 children under 5 years would allow an estimation of the prevalence of diarrhoea. However, considering a non-response rate of 10% the figure was rounded off to 300 children.

### **3.5.2 Sample size for in-depth interview**

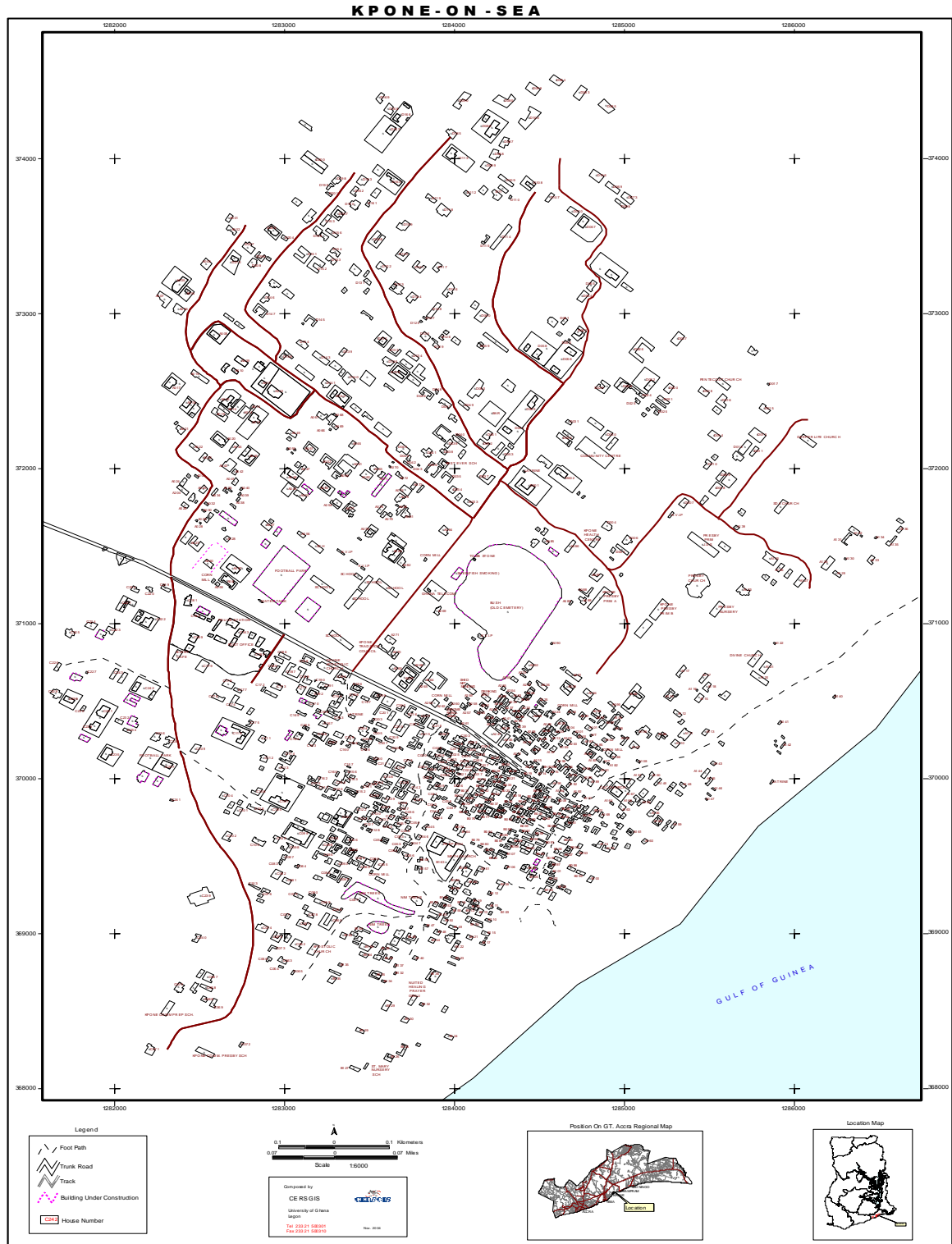
Considering the fact that Kpone-On-Sea is a relatively small community one nursing officer in charge of Reproductive and Child Health unit at the Kpone health centre and an environmental officer for the Kpone sub-district were selected for the study.

## **3.6 Sampling method**

### **3.6.1 Sampling of children under 5 and caretakers for questionnaire interview**

The Kpone-On-Sea community has been GIS-mapped into 4 sectors. 300 houses with children under 5 years were selected by stratified random sampling from the four sectors of Kpone-On-Sea for the study. The first house in each sector was identified by the use of the GIS map. From the first house the next three houses facing us was selected as the next. We moved in that manner until the whole sector was covered. Where a house had more than one household (family), a representative household was selected by simple random sampling method (lottery) and where a selected household had two or more children under 5 years, the youngest was selected for the study. Since the number of children under 5 years might vary for each sector, proportional sampling was carried out to ensure the selection of a representative group of children from each sector.

Fig 3.1: GIS Map of Kpone-On-Sea, Ghana



### **3.6.2 Selection of respondents for in-depth interview**

The qualitative study comprised two in-depth interviews. The two interviewees comprising one (1) nursing officer and the chief environmental health officer were selected purposively from the Kpone Health Centre and Kpone Environmental Health Department respectively.

### **3.7 Data Collection Techniques/Methods and Tools**

All data on exposure to sanitation factors were collected during a home visit performed during the study period. Home visits were not prearranged and lasted approximately 25-30 minutes. Each interviewer (trained research assistant) visited ten (10) households per day. The child's main caretaker was interviewed.

Data collection consisted of structured questionnaire interviews and direct observations, after obtaining approval from the participants through informed consent (Appendix I). The questionnaire generally comprised close-ended questions which were administered to caretakers of selected children. The questionnaire gathered information on the occupation, level of education and socio-economic status of the caretaker, child factors such as birth weight, age, birth order and the child's experience of diarrhoea in the past 2 weeks. Sanitation factors assessed by the questionnaire include source of water supply, type of toilet facility available to the household, whether drinking water was treated prior to use and type of cleaning material used for the child (Appendix II).

Upon completion of the face-to-face interview, additional information on the source of water supply, conditions of toilet facilities, waste water disposal facilities, refuse disposal

facilities and the general hygiene conditions of the caretaker's house with the use of an observational checklist. The checklists consisted of a set of questions which had "yes" or "no" answers. The questions were structured so that "yes" answers indicated a risk of microbial contamination and "no" answers indicated that that particular risk was absent. Each "yes" answer scored one point and "no" answers scored zero points each. At the end of the inspection, the points were added up and the higher the total the more likely microbial contamination was present. Places inspected include the area around the source of drinking water, the refuse disposal site, the toilet facility at home and the general surroundings of the house (Appendix III). Results from the checklists were then incorporated into the tables that detailed responses on sanitation from the questionnaire interviews

Two in-depth interviews were granted by a Nursing Officer at the Reproductive and Child Health (RCH) unit of the Kpone Health Centre and the Chief Environmental Health Officer of the Kpone sub-district with the use of in-depth interview guides to provide their expert opinions on issues relating to the study at Kpone (Appendices IV, V).

### **3.8 Quality control**

The structured questionnaire, observational checklist and in-depth interview guides were created and revised based on reference materials and recommendations from supervisors. Data collection tools were pre-tested for reliability. The following steps were carried out prior to the collection of the data:

- a. Six research assistants were recruited to become interviewers for the study. They were trained on the proper way of collecting data such as explaining the purpose of data collection and explaining each item without inducing bias to the respondents, how to check data for completeness and how to handle difficulties felt by the study participants.
- b. After completing the training of the interviewers, questionnaires were administered to caretakers of selected children and checklists were used during the inspection of their respective homes.

All questionnaires that were returned were checked for mistakes and completeness. Questionnaires that had unclear responses or many missing information that could not be clarified were excluded. Double entry of data was done to reduce data entry errors and validate authenticity of data.

### **3.9 Data processing and analysis**

All data collected by questionnaire and direct observation were entered into a computer and statistical analyses were performed using the SPSS version 16 software. Comments gathered from the in-depth interviews were transcribed manually.

#### **3.9.1 Statistical methods**

The prevalence of diarrhoea among children under 5 years at Kpone-On-Sea was calculated as the number of children ill with diarrhoea (as stated by the child's caretaker) at anytime during the previous two weeks (inclusive of the date of interview) divided by



the total number of children included in the study during the entire study period. This was presented as frequency tables and charts.

The conditions of water supply, waste disposal and housing sanitation in homes of caretakers of the selected children under 5 years were described using frequency distribution tables and charts.

Bivariate analyses (cross tabulations) were conducted on each variable against the occurrence of diarrhoea and Pearson's chi-square and Fisher's exact test (2-sided) were used to test associations between each variable and the occurrence of diarrhoea. A significance level of 5% was considered. Hence, all associations that had corresponding p-values less than 5% were considered significant. Since the occurrence of diarrhoea is a binary variable – has two levels defined as YES or No – binary logistic regression controlling for a set of potential confounders was used. These confounders were selected on the basis of the preliminary bivariate analysis conducted which revealed confounders that were statistically significant. Odds ratios quoted are derived from the binary logistic regression analysis and are given with 95% confidence intervals.

### **3.10 Ethical considerations**

Ethical approval for permission to proceed with the study was sought from the Ethical Review Committee of the Health Research Unit of Ghana Health Service. Permission was sought from the Municipal Director of the Tema Municipal Directorate, opinion leaders (chief and elders) and the head of the Kpone-On-Sea health centre. Informed

consent was sought from respondents (caretakers) after explaining the purpose of the study, its benefits and risks, confidentiality, privacy and voluntary participation.

### **3.11 Pre-testing**

Before the actual data collection, the data collection tools – questionnaire and observation checklist – were pre-tested to determine the clarity of questions and make changes where necessary to improve upon the reliability of the results that were obtained. This was done at Kpoi-Ete, a neighbouring rural community of Kpone-On-Sea.

## CHAPTER FOUR

### 4.0 RESULTS

This cross-sectional study was conducted to determine the prevalence of diarrhoea in children under 5 years at Kpone-On-Sea and describe the sanitation factors influencing its occurrence. The investigator interacted with the caretakers of 300 randomly selected children under 5 years. Data was collected through face to face interviews, in-depth interviews and observations. Out of the 300 completed questionnaires 17 had responses that could not be clarified, hence were excluded. The results presented below are from 283 (94.3%) completed questionnaires which far exceeded the minimum required.

#### 4.1 Characteristics of children under 5 years and their caretakers at Kpone-On-Sea

Age of child, sex, birth order, birth weight and breastfeeding history for the first 6 months of life were included. A majority (78.8%) of children were aged 12-59 months. The median age was 24 months, with 1 week and 59 months being the youngest and oldest respectively. Birth weight was ascertained by the use of child health record cards. More than half (60.4%) of the children weighed 2.5 kg or more at birth. However, birth weight was not reported for 37.5% of the children. Surprisingly, as much as 11.8% of the children were reportedly not breastfed in the first 6 months of life.

Over two thirds (69.3%) of the children were not schooling and the majority (74%) were handled by 25 to 60 year old caretakers. Over 90% of the children were taken care of by their mothers. A greater proportion (70.8%) of the children had caretakers who had some basic education while 18.1% never had any formal education. More than half (56.5%) of the children had caretakers who owned small businesses such as hairdressing, trading and dress making. Only 6.7% were in agriculture (Table 4.1).

**Table 4.1: Background characteristics of children under 5 years at Kpone-On-Sea**

<b>Characteristic</b>	<b>Number (N=283)</b>	<b>Percentage (%)</b>
<b><i>Age (months)</i></b>		
< 6	27	9.5
6-11	33	11.7
12-23	72	25.4
24-35	58	20.5
36-47	51	18.1
48-59	42	14.8
<b><i>Sex</i></b>		
Male	164	58.0
Female	119	42.0
<b><i>Birth weight (kg)</i></b>		
Less than 2.5	6	2.1
2.5 or more	171	60.4
Don't know	106	37.5
<b><i>Birth order*</i></b>		
First	90	32.1
Second	81	28.8
Third or above	110	39.1
<b><i>Breastfeeding during first six months*</i></b>		
Exclusive	185	66.1
Supplementary	62	22.1
None	33	11.8
<b><i>Currently in school</i></b>		
Yes	87	30.7
No	196	69.3
<b><i>Age of caretaker (years)</i></b>		
Less than 25	73	26.0
25 or more	208	74.0
<b><i>Caretaker's level of formal education*</i></b>		
No formal education	51	18.1
Basic	199	70.8
Secondary or Higher	31	11.1
<b><i>Caretaker's occupation</i></b>		
None/Housewife	97	34.3
Agriculture	19	6.7
Small business	160	56.5
Service worker	7	2.5

\* Total does not include cases with missing information

#### **4.2 Practices of the caretakers of children under 5years at Kpone-On-Sea**

It is now widely accepted that water supplies and proper waste management, though necessary for the prevention of diarrhoeal diseases in young children, are not sufficient unless they are accompanied by changes in domestic hygiene behavior. A number of specific behaviours help enteric pathogens to spread and thus increase the risk of diarrhoea. These include using infant feeding bottles, storing cooked food at room temperature, failing to wash hands with soap before handling food after defecation, or after handling faeces and failing to dispose of faeces (including infant faeces) hygienically.

In this regard an assessment of the practices of caretakers regarding childhood diarrhoea was conducted by asking a set of questions. Responses to questions were scored such that negative practices scored higher points than positive ones. However, this portion of the questionnaire had a lot of missing or inconsistent information, hence the inability to categorise caretakers into specific practice groups.

A nursing officer at the Kpone Health said this about caretakers:

*“A major cause of diarrhoea here is the practices of caretakers of children under 5 years. Caretakers lack adequate knowledge about the causes of childhood diarrhoea and its prevention. For instance caretakers do not know why they are advised to exclusively breastfeed their babies in the first six months of the child’s life”*

The results obtained from caretakers who provided responses to specific questions on their practices indicate that, indeed caretaker practices in Kpone-On-Sea are generally not very encouraging. For instance, just a little over half of the caretakers who responded to questions on hand washing, reported washing their hands with soap and water before

preparing child's food (53.2%) or feeding the child (58.1%). 74% washed their hands with soap after visiting the toilet and a little over one-tenth (10.8%) fed children with cutlery only. For children who drank water, only 29.3% drank boiled/bottled/sachet water. This means that a majority of children drank water from the taps (64.8%) whilst very few (2.2%) drank from a well. On the disposal of child's faeces only 10.8% reportedly threw stools into a latrine.

Table 4.2 shows some hygiene practices of caretakers at Kpone-On-Sea.

**Table 4.2 Hygiene practices of caretakers of children under 5 years at Kpone-On-Sea**

<b>Practice of caretaker in relation to diarrhoea</b>	<b>Percent (%)</b>
1. Washes hands with water and soap before preparing child's food	53.2
2. Washes hands with water and soap before feeding child	58.1
3. Washes eating utensils of child with water and soap	95.1
4. Washes hands with water and soap after visiting the toilet	74.4
5. Keeps leftover foods in a refrigerator	10.3
8. Feeds child with cutlery only	10.8
11. Washes nipples prior to breastfeeding	49.0
12. Washes feeding bottles with soap and water and boils afterwards	48.0
13. Gives boiled, bottled or sachet water to child	29.3
14. Threw child's stool in a latrine the last time the child passed stools	10.8

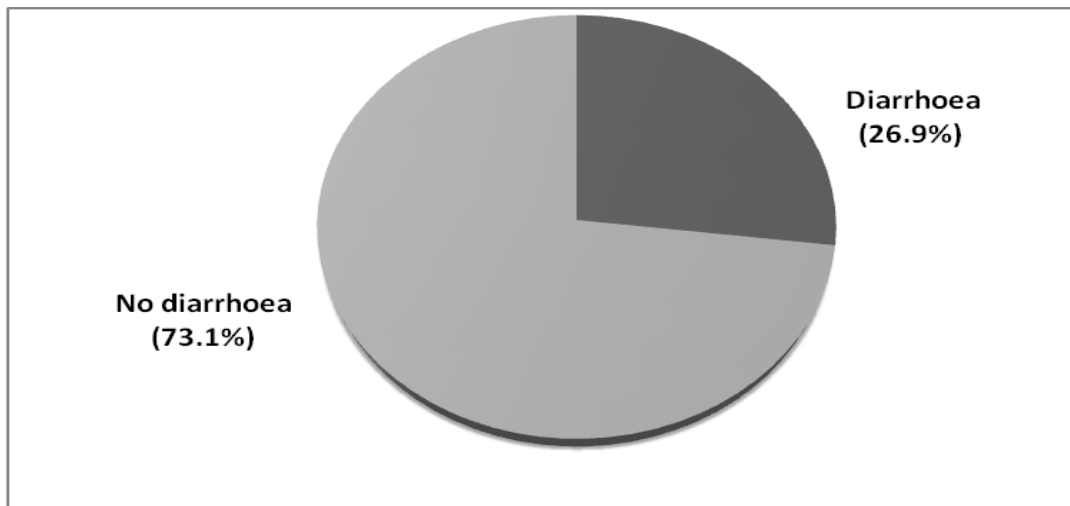
#### 4.3 Prevalence of diarrhoea in children under 5 years at Kpone-On-Sea

The selected children's experience of diarrhoea (as stated by the caretaker) during the past 2 weeks preceding the survey were recorded. Although 105 children reportedly had diarrhea only, 76 of them passed three or more loose stools on that day. Hence, the prevalence of diarrhoea in the past two weeks preceding the interview was 26.9% (Figure 4.1).

A rather high proportion (30%) of the children reportedly had diarrhoea with blood, a symptom of dysentery. This is contrary to a response by a nursing officer at the Kpone Health Centre during an in-depth interview:

*“Children hardly report to the health centre with bloody diarrhoea. However, they present with vomiting and mucous stools, especially those in the 6-12 months age group.”*

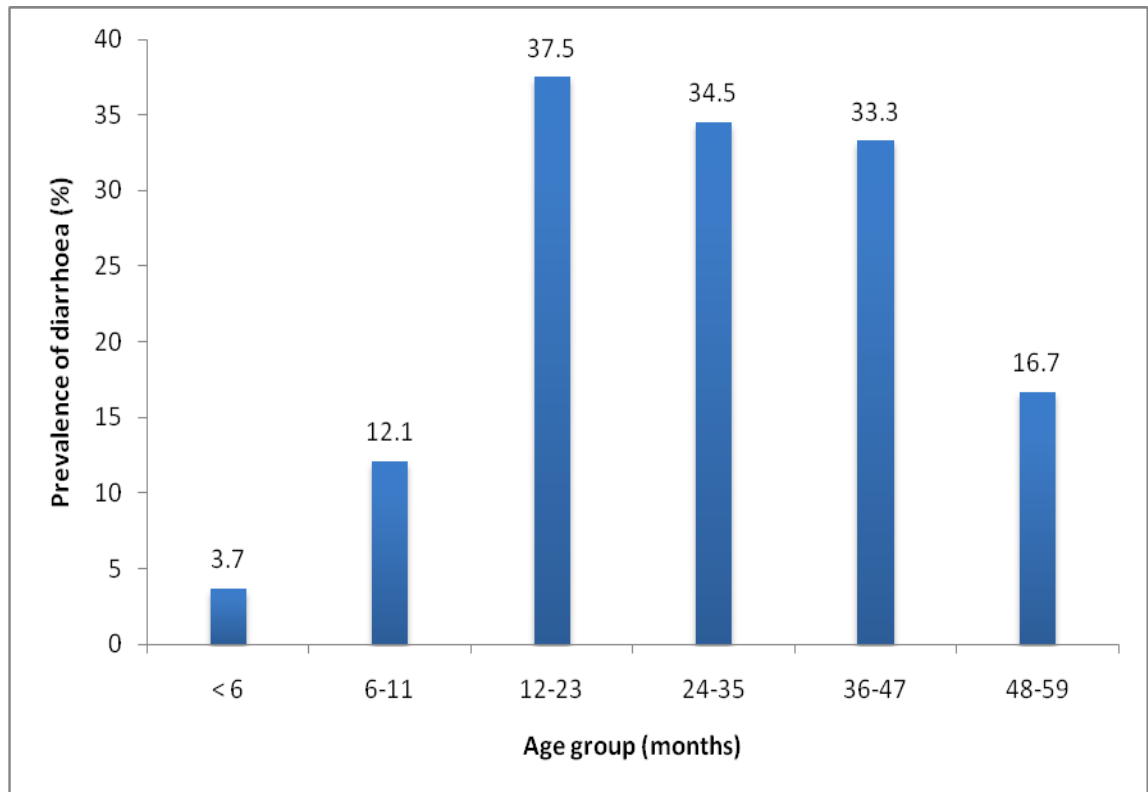
**Figure 4.1: Prevalence of diarrhoea in children under 5 years at Kpone-On-Sea, 2010**



As indicated in Figure 4.2 below, the differences in diarrhoea morbidity across age groups were striking. Diarrhoea prevalence increased with age and peaked at 12-23 months (37.5%) then declined at the older ages. A response from an in-depth interview with a nursing officer at Kpone Health Centre confirms this trend:

*“Majority of the children who report here with diarrhoea fall in the 1-3 years (12-35 months) age group. These children are usually at the weaning stages and have already started to crawl or walk.”*

**Fig 4.2: Age-specific prevalence of diarrhoea in children under 5 years at Kpone-On-Sea, 2010**





#### **4.4 Sanitation conditions in homes of children under 5 years at Kpone-On-Sea**

##### **4.4.1 Water supply**

In Table 4.3a, the results reveal that nearly all (93.0%) of the children lived with households that obtained water from an ‘improved’ source. The majority (80.2%) used water from a community stand pipe. This confirms a statement made by an environmental health officer during an in-depth interview:

*“The people depend on pipe-borne water from the Akosombo Lake. I do not know about any closure of taps or shortage of water”*

However, a nursing officer made a comment contrary to the above:

*“The challenges we are facing here are with the water supply...Water supply is inadequate. Most of the people fetch water from a stream for cooking or bathing”.*

Although a majority of the respondents use an improved source of drinking water, most of it is bought by the bucket or gallon from large storage tanks in households served with potable pipe-borne water. Upon inspection of the area around the source of water, it was found that less than half (39.6%) of these sources of water had no risk of contamination with diarrhoea-causing pathogens. However, a little over half (53.4%) of the buyers either collected or stored this water unhygienically. 67.1% used adequate quantities of water.

##### **4.4.2 Waste disposal**

###### **4.4.2.1 Availability of a toilet facility at home**

Analyses of responses on human excreta disposal indicate that over three quarters (86.6%) of the households lacked toilet facilities at home and only 15.8% of the children used the toilet facilities at home. Of those with a toilet facility, 60.5% used a pit latrine.

The environmental health officer had this to say about toilet facilities:

*“The people lack toilet facilities and so use open spaces at night. The major factor is the lack of funds to construct these toilets. Flush toilets are constructed for people at a fee. I don’t know the proportion of households with a flush toilet.*

Nearly three quarters (71.1%) of the toilet facilities inspected were found to be in unhygienic conditions. Most (61.8%) of them lacked a hand washing facility (Table 4.3a).

#### **4.4.2.2 Refuse and Waste Water disposal**

A little over two thirds (69.6%) of the households had a garbage bin for disposing of refuse while 11.7% threw rubbish in a nearby bush or around the houses. An environmental health officer said this about refuse disposal in the community:

*“There is house-to-house refuse collection service provided by Zoomlion Ghana Limited. Dust bins are provided and the refuse is collected from specific picking points. However, about 50% of the people here litter the surroundings. They dump rubbish on the ground making its collection quite difficult. Some do this because they are just stubborn”.*

Although about 88.3% of the households appeared to dispose of refuse in a sanitary manner (burn, bury, use garbage bin), conditions around almost half (48.8%) of the refuse disposal sites were not hygienic at the time of inspection. A majority (81.3%) had refuse that was accessible to flies.

For domestic waste water disposal, the survey revealed that as much as 83.0% of households had no proper drainage facility for grey water or kitchen waste. Hence, households (91.1%) threw waste water anywhere around the house (Table 4.3b)

#### **4.4.3 Housing sanitation conditions:**

Nearly all (90.1%) of the houses were built in cement and about half (51.9%) were in poor hygiene conditions at the time of observation. 65.0% had floors made of sand, 82.2% had lots of houseflies and 70.3% had opened cooking areas (Table 4.3b).

**Table 4.3a: Water supply and human excreta disposal in homes of children under 5 years at Kpone-On- Sea**

Sanitation factor	Number(N=283)	Percentage (%)
<b>Water supply</b>		
<i>Source of drinking water</i>		
Private indoor pipe	34	12.1
Community stand pipe	227	80.2
Rainwater	2	0.7
Well	14	4.9
Other	6	2.1
<i>Method of collecting/storing drinking water</i>		
Hygienic	132	46.6
Unhygienic	151	53.4
<i>Quantity available daily per head (litres)</i>		
Less than 20	93	32.9
20 or more	190	67.1
<i>Risk of contamination of source of drinking water</i>		
Present	171	60.4
Absent	112	39.6
<b>Human excreta disposal</b>		
<i>Type of toilet facility in house</i>		
Flush toilet	15	5.3
Pit latrine	23	8.1
No toilet facility	245	86.6
<i>Hygiene condition of toilet facility*</i>		
Adequate	11	28.9
Inadequate	27	71.1

\* Total does not include cases with missing information

**Table 4.3b: Waste disposal and housing sanitation conditions in homes of children under 5 years at Kpone-On-Sea**

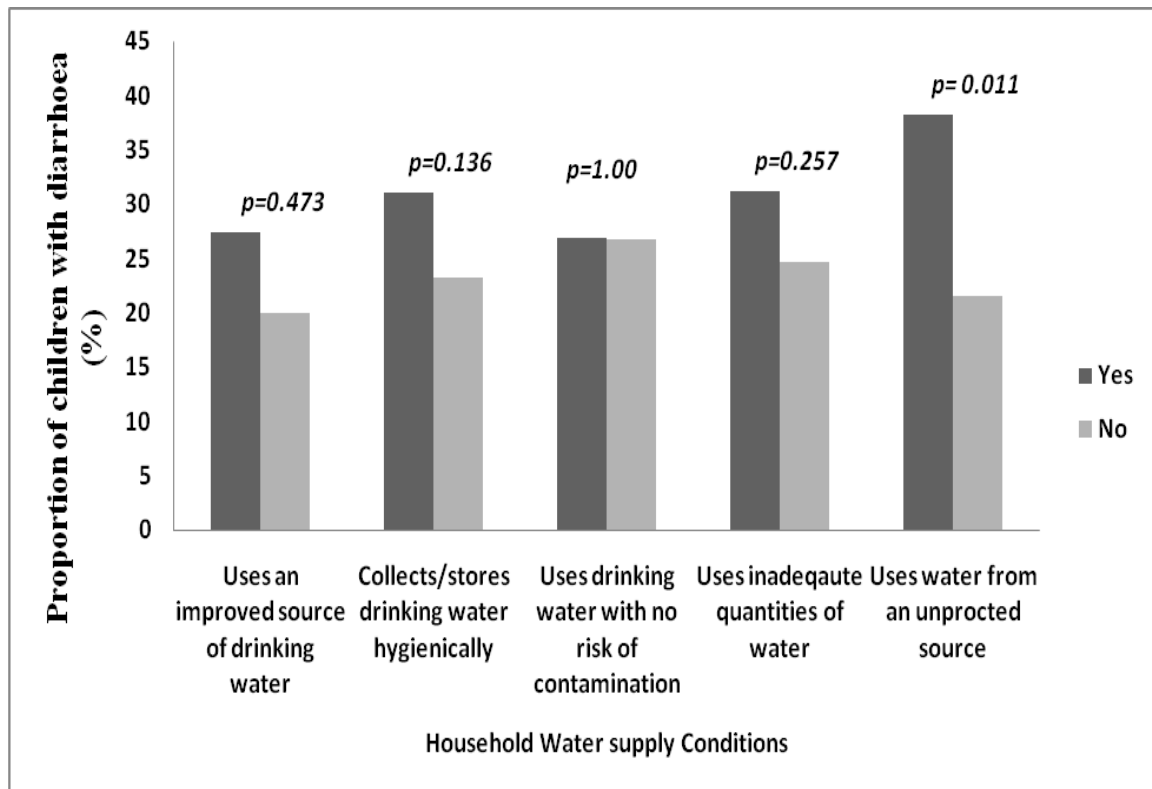
<b>Refuse disposal</b>	<b>Number(N=283)</b>	<b>Percentage (%)</b>
<i>Method of refuse disposal</i>		
Burn	43	15.2
Bury	10	3.5
Garbage bin	197	69.6
Throw around the house	33	11.7
<i>Hygiene condition of refuse disposal site</i>		
Adequate	145	51.2
Inadequate	138	48.8
<b>Waste water disposal</b>		
<i>Method of waste water disposal</i>		
Drainage system	48	17.0
Pour around the house/gutter	235	83.0
<b>Housing sanitation condition</b>		
<i>Physical set-up of house</i>		
Mud house	1	0.4
Wooden structure	27	9.5
Cement building	255	90.1
<i>Hygiene condition of compound</i>		
Good	136	48.1
Poor	147	51.9

#### 4.5 Association between sanitation factors and the occurrence of diarrhoea in children under 5 years

##### 4.5.1 Water supply

The analysis on water supply revealed a statistically significant association ( $p = 0.011$ ) between the use of water from an opened or unprotected source (large uncovered storage tanks placed outside the house, rivers and unprotected wells) and the occurrence of diarrhoea. All other factors under water supply did not reveal any significant association at the bivariate level.(Figure 4.3).

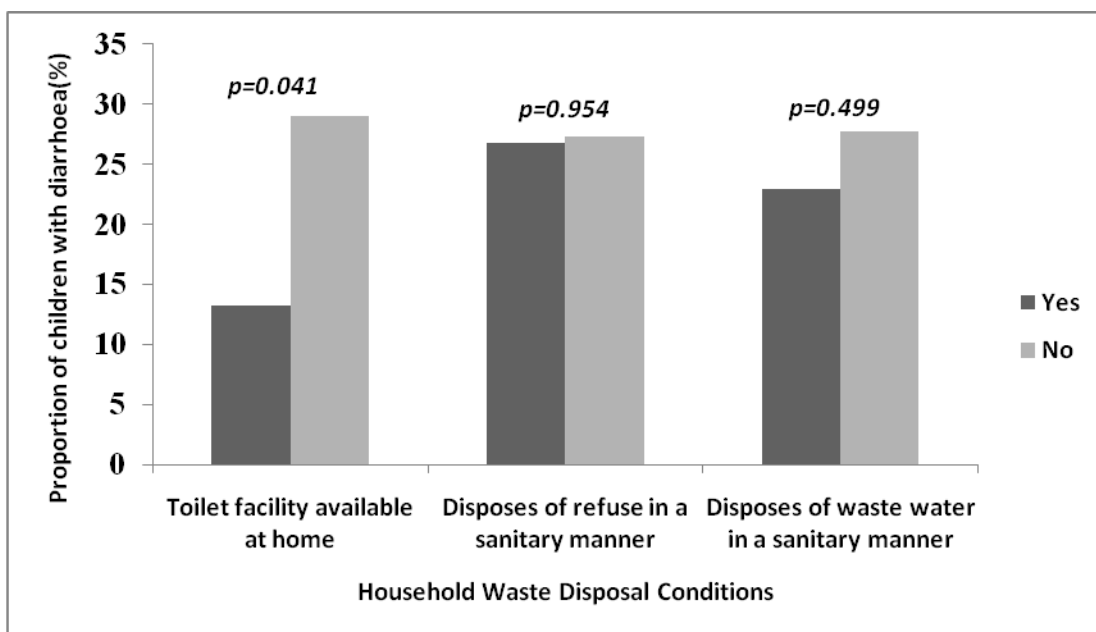
**Fig 4.3: Association between household water supply conditions and diarrhoea occurrence in children under 5 years at Kpone-On-Sea**



#### 4.5.2 Waste disposal

On waste disposal, there was a significant association between access to a toilet facility at home and diarrhoea. Lack of a toilet facility at home increased the risk of a child experiencing diarrhoea ( $p = 0.041$ ) (Figure 4.4).

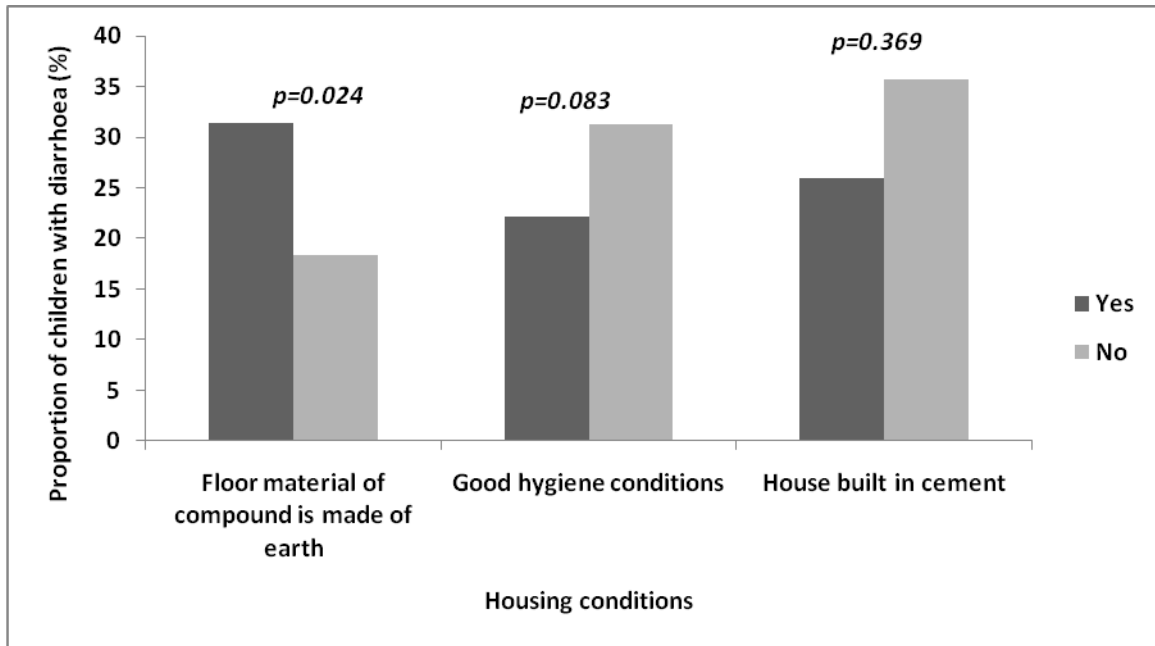
**Fig 4.4: Association between household waste disposal conditions and diarrhoea occurrence in children under 5 years at Kpone-On-Sea**



#### 4.5.3 Housing sanitation conditions

Among housing sanitation conditions, the type of the floor material of the compound was significantly associated with the occurrence of diarrhoea among the children ( $p = 0.024$ ). Children living in compounds with floor materials made of earth had a higher prevalence of diarrhoea. No other housing condition showed a significant association with diarrhoea (Figure 4.5).

**Fig 4.5: Association between housing sanitation conditions and diarrhoea occurrence in children under 5 years at Kpone-On-Sea**



Simple logistic regression analyses were further conducted to calculate estimates of odds ratio with 95% Confidence Interval, using a null value of 1.00 to determine the limit of acceptance of the odds ratio estimate. To adjust the odds ratio for the effects of potential confounders - age of the child, education of the caretaker and the employment status of the caretaker- as indicated in many studies, a multiple logistic regression analysis was performed.

The use of an unprotected (open) source of drinking water was independently associated with the occurrence of diarrhoea. Children who lived in households that obtained drinking water from unprotected sources had a higher risk of diarrhoea (OR=2.25; 95%

CI 1.19-4.26). This association reduced in the presence of other factors but was not significant at the multivariate level (OR=1.99 95% CI 0.97-4.07).

Another significant association was observed between the lack of a toilet facility at home and the occurrence of under-5 diarrhoea. Children who lived with households that had no access to a toilet facility at home appeared to have an increased prevalence of diarrhoea (OR=2.70; 95% CI 1.01-7.14). The association reduced after adjustment and remained insignificant (OR=2.39; 95% CI 0.75-7.65).

The type of floor material of the compound showed a significant relationship with the occurrence of diarrhoea. Those living in houses with floor materials made of earth had the higher risk of diarrhoea (OR=2.03; 95% CI 1.12-3.69). This effect was attenuated when included in the second model. However, the association was no longer significant after adjusting for the effect of potential confounders (OR=1.45; 95% CI 0.72 – 2.90) ((Tables 4.4a and 4.4b).

Tables 4.4a and 4.4b show the association between sanitation factors and the occurrence of diarrhoea.



**Table 4.4a: Association between sanitation factors and diarrhoea in children under 5 years at Kpone-On-Sea (Logistic regression analysis)**

Sanitation factor	Diarrhoea		Total (N=283)	OR <sup>1</sup>	95% CI	OR <sup>2</sup>	95% CI
	Yes n	No n					
<b>Source of drinking water</b>							
Improved	72	191	263	1.51	0.49-4.65	1.07	0.26-4.46
Unimproved	4	16	20				
<b>Collection/storage of drinking water</b>							
Hygienic	41	91	132	1.49	0.88-2.53	1.50	0.78-2.88
Unhygienic	35	116	151				
<b>Risk of contamination of drinking water</b>							
Present	46	125	171	1.01	0.59-1.72	Not included in the model	
Absent	30	82	112				
<b>Quantity of water</b>							
Inadequate	29	64	93	1.38	0.80-2.39	1.61	0.85-3.07
Adequate	47	143	190				
<b>Source is opened/unprotected</b>							
Yes	21	34	55	2.25	1.19-4.26	1.99	0.97-4.07
No	45	164	209				
<b>Presence of toilet facility</b>							
No	71	174	245	2.70	1.01-7.14	2.39	0.75-7.65
Yes	5	33	38				
<b>Method of refuse disposal</b>							
Unsanitary	9	24	33	1.02	0.45-2.32	Not included in model	
Sanitary	67	183	250				

**Table 4.4b: Association between sanitation factors and diarrhoea in children under 5 years at Kpone-On-Sea (Logistic regression analysis)**

Sanitation factor	Diarrhoea		Total (N=283)	OR <sup>1</sup>	95% CI	OR <sup>2</sup>	95% CI
	Yes	No					
	n	n					
<b>Method of waste water disposal</b>							
Unsanitary	65	170	235	1.28	0.62-2.70	Not included in model	
Sanitary	11	37	48				
<b>Floor material of compound is made of earth</b>							
Yes	58	127	185	2.03	1.12-3.69	1.45	0.72-2.90
No	18	80	98				
<b>General hygiene condition of compound</b>							
Poor	46	101	147	1.61	0.94-2.79	1.24	0.65-2.38
Good	30	106	136				
<b>Housing type</b>							
Mud house/wooden	10	18	28	1.59	0.70-3.62	Not included in the model	
Cement building	66	189	255				

OR<sup>1</sup> = Odds Ratio Estimate from simple logistic regression analysis; OR<sup>2</sup> = Odds Ratio Estimate from multiple logistic regression model containing source of water, method of storing or collecting water, quantity of water available daily per head, presence of toilet facility, use of an unprotected source of water and type of floor material of compound, age of child, employment status of caretaker and education of caretaker); CI= 95% Confidence Interval for Odds Ratio

As already observed in the Tables 4.4a and 4.4b, the use of an unprotected source of drinking water, lack of a toilet facility at home and living in houses with surroundings made of earth or soil were independently associated with the occurrence of diarrhoea in children at Kpone-On-Sea.

Quite interestingly however, the use of an improved source of water and the hygienic collection or storage of drinking water were associated with diarrhoea, though the associations were not significant. Reductions in odds ratios were seen after adjustment but still remained insignificant.

Not surprisingly, use of inadequate quantities of water, use of drinking water from sources with some risk of contamination, unsanitary disposal of refuse and waste water, living in poor hygiene surroundings and living in a mud house or wooden structure were associated with diarrhoea. These associations remained insignificant in both models.

## CHAPTER FIVE

### 5.0 DISCUSSION

In the previous chapter, the prevalence of diarrhoea in children under 5 years at Kpone-On-Sea was determined. The sanitation factors that may be influencing its occurrence were also described. This chapter seeks to explain the prevalence of diarrhoea in under-5 children and the sanitation factors observed at Kpone-On-Sea. In addition, the possible health implications of the results are considered.

This study was carried out in Kpone-On-Sea, a coastal fishing village in south eastern Ghana facing the challenges of inadequate sanitation and high diarrhoeal disease occurrence in children under 5 years. Findings from this study have practical implications for the formulation of child survival and environmental health intervention policies

#### 5.1 Prevalence of diarrhoea in children under 5 years at Kpone-On-Sea

In spite of the remarkable success in the use of the Oral Rehydration Therapy (ORT), dehydration caused by severe diarrhoea remains a major cause of ill-health and death in children in Ghana (GDHS, 2008). Poor sanitation has been found in many studies to be associated with diarrhoeal morbidity and mortality. In Ghana, sanitation coverage still remains fairly low with only 44% and 61% of the rural and urban populations respectively, having access to safe water while only 11% of the rural and 40% of the urban populations have access to toilet facilities (Water Aid, 2006).

The reported 2-weeks prevalence of diarrhoea in children under 5 years in this study was 26.9%. This figure is higher than the 21.3% reported for rural areas in Ghana (GDHS,

2008) and 19.2% found in another study conducted in the Accra Metropolitan Area by Boadi and Kuitenen, (2005). It is also a confirmation of a comment made by a nursing officer at the Kpone Health Centre during an in-depth interview:

*“Yes, diarrhoea in children under 5 years is a major problem here because the people lack adequate water supply, toilet facilities and other sanitation facilities.”*

These differences could be explained by the fact that the prevalence of diarrhoea varies seasonally (GDHS, 2008).

In general the study found that the prevalence of diarrhoea in the 2-weeks reference period peaks at 12-23 months and declines at older ages. This pattern is similar to that which was found in the recently conducted demographic and health survey in Ghana (GDHS, 2008) but differs from those found in two studies in Egypt and India. In these studies, the rates were highest in the age groups of 6 months to less than 12 months and were lowest among children aged between 48 months to less than 60 months (El-Gilany et al., 2005; Ahmed et al., 2008).

The low prevalence of diarrhoea observed in the less than 6 months age group in this study could be a clear indication of the protective effect of exclusive breastfeeding in the first six months of life. Breast milk is a nutritious and generally safe food for newborn infants, and exclusive breast-feeding protects against diarrhoea by minimizing the infant's exposure to food-borne and water-borne pathogens (Motarjemi et al., 1993). In addition to breast milk, innate immunity and less exposure to contaminated agents due to adequate care provided by mothers, probably reduces the prevalence of diarrhoea at this stage.

On the other hand, the prevalence of diarrhoea increased among children in the 6 to 11 months age-group and peaked at 12-23 months because it is at these stages that children

start to crawl or walk and are at increased risk of contamination from the environment. The introduction of other liquids and foods at this time of weaning can also facilitate the spread of disease-causing microbes (GDHS, 2008).

Boadi and Kuitenen, (2005) found in their study that children who were regularly fed on street food were also usually at a much higher risk of contracting diarrhoea and this accounted for a majority of dysentery cases. A nursing officer at the Kpone Health Centre described a typical case of diarrhoea reported to the health centre and this is what she had to say:

*“The child was about 12 months old and came with diarrhoea and vomiting that had lasted for about 3 days. The child had sunken eyes and passed bloody stools-an indication of dysentery. The mother of the child was a fish monger who usually left the child in the care of the grandmother. Apparently, the child had been fed on street food. The child was also undernourished”*

This statement is indicative of the fact that the consumption of street foods prepared under unhygienic conditions could pose a major risk of diarrhoea to children. In an in-depth interview with an environmental health officer at Kpone, the issue of street food vending was raised. When asked about the challenges being faced by the outfit he had this to say:

*“Food handlers do not have adequate facilities such as good kitchens, serving and storing spaces. Hence difficulty in ensuring that foods are free from contamination”*

Finally, the declining prevalence of diarrhoea with increasing age (24-59 months) can be explained by the probable acquisition of immunity from repeated exposure to diarrhoea-causing pathogens.

## **5.2 Sanitation factors influencing the occurrence of diarrhoea in children under 5 years at Kpone-On-Sea**

The occurrence of diarrhoea is a complex process determined by a multiplicity of factors. Sanitation factors have been found to contribute to a majority of diarrhoeal cases in the developing world. This study revealed that the lack of a toilet facility at home, unsanitary disposal of refuse and waste water, and even obtaining water from sources considered to be of good quality could influence the occurrence of diarrhoea in children under 5 years of age.

### **5.2.1 Water supply**

#### **5.2.1.1 Quality of drinking water**

The quality of water used by households was determined based on four variables – source of drinking water, risk of microbial contamination of the water at the source, mode of collecting or storing drinking water and the use of an unprotected source of water. None, except the use of an unprotected source of water, was found to have any statistically significant association with diarrhoea.

The water sources that supplied the majority of the households with drinking-water were “improved” sources of water. Improved sources of water are those considered to be of suitable quality for drinking (WHO/UNICEF, 2006). It was therefore surprising to find that children in households which used improved sources of water rather had an additional likelihood of developing diarrhoea (OR=1.51) than children who did not. This finding contradicts that which was found during the GDHS (2008), that the use of

improved sources of water was useful in preventing diarrhoea in children. Furthermore, it is contrary to the findings from a study conducted in Accra by Boadi & Kuitenun (2005) where childhood diarrhoea decreased with a standpipe and indoor pipe (improved sources). Children in households which reportedly collected and stored water hygienically were 49% times more likely to have diarrhoea than those who did not (OR=1.49).

These findings could be attributed to a number of reasons. Firstly, this study revealed that a majority (80.2%) of the households bought water by the bucket or gallons from a communal stand pipe. These community stand pipes can be substantial distances from households. Microbial contamination of domestic drinking water during and after collection from the source has been found in many studies to be a problem for such households, occurring even where the water sources are uncontaminated. Such post-source contamination results in poorer water quality in storage vessels within households (Gundry et al, 2004). Moreover a majority (177 out of 283) of children who drank water were reportedly given tap water by their caretakers, whilst only 6 out of 263 reportedly drank water from a well. This observation means therefore that provision of potable drinking water alone may not be enough to drastically reduce the occurrence of diarrhoea, since contamination of water can occur at different points prior to consumption.

In addition, in order to avoid queues at the communal stand pipes, members of some households resort to fetching water from large storage tanks filled with water in the homes of vendors. Studies have shown that the risk of contamination of vended water is high due to poor storage and mishandling. Usually clients are allowed to fetch water from storage tanks or directly from the tap. As different clients handle water from the same



storage container or from the same standpipe, the possibility of transmitting pathogenic organisms on the hands of clients increases with each client (Gundry et al., 2004). An environmental officer said this about water storage in the community:

*“We advice people on the use of appropriate storage vessels (covered containers) to prevent the breeding of mosquitoes. Most people store large quantities of water in storage tanks specifically Polytank”*

Furthermore, due to the intermittent flow of water in many parts of the city, water vendors have to store water for longer periods in order to meet the demands of their clients. The contamination of water resulting from long periods of storage has been amply demonstrated in the literature according to Roberts et al, (2003). The high incidence of diarrhoea associated with vended water confirms studies, which found the contamination of household water from a source outside the home, to pose a greater risk of diarrhoea than any contamination within the household (VanDerslice and Briscoe, 1993).

Finally, the member of the household who collects this drinking water from the source is very important. Younger children are more likely than adults to contaminate water during collection from its source. Children were sometimes seen collecting water from communal standpipes during field stay (Appendix VI).

A review by Esrey et al., (1991) on the effects of improved water supply on diarrhoea revealed that health benefits of water supply were only obtained when the water supply was piped into or near the home, whereas in those that reported no benefit, the improved water supplies were protected wells, tube wells, and standpipes. This is to say therefore that provision of improved water supply that could be substantial distances from households may not effectively reduce the occurrence of diarrhoea.

Children in households which used water from sources observed to have some potential risk of microbial contamination had almost the same likelihood of developing diarrhoea (OR = 1.01) as those who used water from sources considered to have no risk of microbial contamination. This observation could be explained by the fact that contamination of drinking water could occur at any point from its collection from the source to point of use. Hence, there is the need to ensure that water collected from a clean source is always hygienically handled in order to avoid any form of contamination prior to use.

The quality of water was also assessed by whether it was obtained from an unprotected source or not. Expectedly, children whose caretakers fetched water from sources that were observed to be opened or unprotected were about 2 times as likely as other children to have diarrhoea. Although only 20.8% of these drinking water sources were observed to be opened or unprotected the association seen was significant in the simple model. Unprotected sources of water are generally classified as being of low quality since they are opened constantly to all forms of contamination. Water from these sources always require considerable treatment or disinfection prior to use.

#### **5.2.1.2 Quantity of water available to household**

As expected, children who lived in households that used inadequate quantities of water (less than 20 litres per head) daily were more likely to develop diarrhoea than those who used adequate quantities of water daily (OR=1.38; 95% CI 0.80-2.39). The availability of water usually facilitates proper hygiene behaviours. It makes hand washing for

instance easier. Increased water availability and quantity associated with improved hygiene, may reduce faecal contamination of the hands and improve proper cleaning of utensils, food, and the home environment (Boadi and Kuitenen, 2005). Esrey et al., (1991) after reviewing many studies regarding water and hand washing, concluded that water availability was probably more important than water quality.

## **5.2.2 Waste disposal**

### **5.2.2.1 Access to toilet facilities**

The household access to a toilet facility showed a significant association with diarrhoea. The association between absence of a toilet facility and diarrhoea is one that has been seen in a previous study by Boadi and Kuitunen, (2005). Improved human excreta disposal was found to have reduced diarrhoeal incidence in a study conducted in a rural district in Malawi by Young and Briscoe (1987). The greatest reductions in diarrhoea have been found with the use of flush toilets and pit latrines.

Almost 90% of the households reported not having a toilet facility in the house. This means that the children are left with the options of using a public latrine or defecating outdoors. Public latrines are usually considered unhygienic and unhealthy for children due the presence of dirty floors and flies. Neighborhood outdoor defecation creates potential dangers of infections from faecal pathogens in contaminated grounds. Children who play on grounds contaminated with fecal matter risk contracting diarrhoea. In addition those who are not accompanied by adults to public latrines may be tempted to pick used cleaning materials on the dirty floors for cleaning after defecating (Appendix VI).

A nursing officer at the Kpone Health centre commented:

*“Children defecate in the bush and since they lack assistance they usually don’t wash their hands after cleaning themselves. They later end up with their fingers in their mouths”*

Consequently, little or no health impact should be expected from water improvement alone as an intervention to reduce diarrhoeal morbidity in areas such as Kpone-On-Sea where the environment may be laden with faeces.

It is worth noting however, that a majority of the children lived in homes without a toilet facility and this may have resulted in the higher prevalence of diarrhea observed among children in such homes.

#### **5.2.2.2 Refuse disposal**

Not surprisingly, unsanitary methods of disposing refuse such as throwing in the bush, in an opened pit or bin around the house was associated with a relatively higher prevalence of diarrhoea. This is similar to results obtained from a study in Nigeria by Oyemade et al, (1998). The presence of refuse around the house increases the prevalence of vectors such as flies and cockroaches which pose tremendous health hazards (Songsore et al., 2006). This association was not significant however.

#### **5.2.2.3 Waste water disposal**

Again pouring of household waste water on the compound of the house or anywhere around the house was associated with a high prevalence of diarrhoea in the children. The

presence of waste water around the house or on the street as a risk for diarrhoea can be seen as a similar result to studies conducted by Heller et al., (2009) and Yongsi (2009). According to Yongsi (2009), considering the nature and origin of wastewater, it is often polluted and therefore should be adequately collected, stored, transported and treated before been released in the environment. However, due to the absence of appropriate sewage system to contain wastewater, the majority of people use various disposal practices that pose serious environmental and health problems. It was observed that a majority of dwellers at Kpone threw waste water around their houses, on the streets or in opened gutters in front of the house due to the lack of proper drainage systems in the area.

### **5.2.3 Housing sanitation conditions**

#### **5.2.3.1 Type of floor material of the compound**

Of particular interest is the significant association between the type of floor material of the surrounding and the occurrence of diarrhoea. Children who lived in houses with floor materials constructed in earth (soil) were more likely to develop diarrhoea than those who lived in houses with floor material constructed in cement or concrete. This observation is similar to that which was made by Woldemicael (2001) during a study on diarrhoeal morbidity in young children in Eritrea. According to Woldemicael (2001), since dirt (earth, sand or dung) floors cannot be washed they are more likely to provide a breeding ground for various diarrhoea-causing agents than non-dirt (concrete or cement) floors. It

was observed that majority of caretakers poured waste water or faeces of babies (which is usually considered harmless by many caretakers) and even threw rubbish on such floors.

### **5.2.3.2 Hygiene conditions of surroundings or compound**

Not surprisingly, living in unhygienic surroundings posed a greater risk of diarrhoea to the children. Some conditions that rendered surroundings unhygienic include the presence of stagnant water, the presence of flies around the house or cooking area and the presence of refuse around the house. The risk of diarrhoea posed by living under such conditions has been amply demonstrated in literature (Songsore et al., 2006; Bozkurt et al., 2003; Boadi & Kuitenun, 2005; Onyamade et al., 1998; Heller et al., 2009; Yongsu, 2009; Woldemicael, 2001).

A nursing officer said this regarding housing conditions in the community:

*“The lack of adequate water supply and waste disposal facilities (refuse disposal and toilets) has rendered their housing conditions very poor”.*

This statement supports the arguments that good water supply and waste (refuse, waste water and human excreta) disposal services promote hygiene behaviour which have been shown in many studies to reduce the occurrence of diarrhoea.

### **5.3 Limitations of the study**

The findings in this study are based on self-reported diarrhoea without any confirmation from a health record or laboratory, and as such the diarrhoea status could be misclassified. Further work could include lab analysis to identify common microorganisms responsible for diarrhoea at Kpone-On-Sea. The actual quality of drinking water was not ascertained through laboratory analysis. The cross-sectional design of this study makes it difficult to make causal inferences from the results.

## CHAPTER SIX

### 6.0 CONCLUSION AND RECOMMENDATIONS

This was a cross-sectional study aimed at determining the prevalence of diarrhoea and to describe the sanitation factors influencing its occurrence in children under 5 years at Kpone-On-Sea. The conclusions and the recommendations made from the study are presented below.

#### 6.1 Conclusions

1. The 2-weeks diarrhoea prevalence of 26.9% in Kpone-On-Sea was higher than that which was quoted in the GDHS (2008) for rural areas. Diarrhoea prevalence peaked at the 12-23 months age group. 3 out of 10 children reportedly had dysentery.
2. Inadequate refuse disposal, poor waste water disposal, inadequate quantities of water, poor housing sanitation conditions and living in a mud house or wooden structure were associated with the occurrence of diarrhoea in children under 5 years of age at Kpone-On-Sea. However, the associations were not significant.
3. Nearly all (92.9%) of the children lived in households that obtained water from improved sources. However, children who drank water from these sources had a higher prevalence of diarrhoea compared to those who drank from sources considered to be of poor quality. This was not significant though.
4. Drinking water from unprotected wells, rivers, streams or water reservoirs, lacking a toilet facility at home and living in a compound made of earth or soil



were significantly associated with the occurrence of diarrhoea in children under 5 years old at Kpone-On-Sea.

## 6.2 Recommendations

1. The Community Water and Sanitation Agency (CWSA) under the Ministry of Water Resources, Works and Housing should place greater emphasis on interventions that improve the quality of water at point-of-use. This could be done by assessing the outcomes of an intervention study on the treatment and storage of water at home. This will be highly beneficial to households which cannot afford potable drinking water piped into their dwelling or yards and as such have to move away from home to obtain drinking water.
2. . The Traditional Council and Waste Management Department, and Water and Sanitation Departments of Kpone should consider improving household access to improved excreta disposal facilities at Kpone-On-Sea. Considering the fact that the people cannot afford the installation of flush toilets, Ventilated Improved Pit (VIP) latrines could be provided to households. These are usually cheaper to build, do not require any water and are usually of good hygiene conditions.
3. The Kpone Environmental Health Department and Kpone Health Centre should intensify health education programmes on sanitation and diarrhoea at Kpone. These should focus on proper personal and domestic hygiene practices since they are important aspects of diarrhoea prevention in children.

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## APPENDICES

### **Appendix I: Sample Informed Consent Form**

**Project Title:** Sanitation factors influencing the occurrence of diarrhoea in children under 5 years at Kpone-On-Sea

**Institutional affiliation:** School of Public Health, College of Health Sciences, University of Ghana, Legon

My name is Monica Baaba Jones, a student from the School of Public Health conducting a research to determine the sanitation factors influencing the occurrence of diarrhoea in children under 5 years at Kpone-On-Sea. This is an academic research in partial fulfillment of the requirements for the award of a Master of Public Health (MPH) degree. The purpose of the project is to present data to help establish the prevalence of diarrhoea among children under 5 years in your community and determine the influence of water supply, waste disposal and housing sanitation on the occurrence of diarrhoea among these children. The project has been reviewed and approved by the School of Public Health and your opinion leaders.

With your permission I would like to collect background data on the selected child under 5 and respective caretaker. Information on water supply, waste disposal and housing sanitation conditions will also be needed. A brief survey of the house will be done to gather information on latrine conditions, cooking spaces and the general hygiene conditions of the surroundings of the caretaker's house.

You may feel uncomfortable with some of the questions we will be posing. However answers to them will provide very vital information to us, the opinion leaders at Kpone-On-Sea and healthcare providers. The information you provide will also help us mitigate the problems of diarrhoea in children due to inadequate sanitation conditions in this community. The findings will inform community leaders about which sanitation factors greatly influence the occurrence of diarrhoea for appropriate interventions and also add to existing knowledge.

This interview will not take more than 30 minutes and will not be stressful but if you are not comfortable with the interview you are free not to participate or to refuse to answer particular questions. Your refusal to participate or continue with the interview will not deprive you of any benefits you are currently receiving. It is fine to refuse to participate. However, I will kindly ask that you participate since your opinion is needed to help solve these problems.

I will not use your child's name or your name in any of our records if you agree to participate. Be assured that the information you provide will be handled with confidentiality and analysis of the data will be done at aggregate level to ensure anonymity.

If you have any questions about the project or your participation feel free to ask or you can contact **Monica Baaba Jones** at the **School of Public Health** on **024-411-3965** with any concerns later.

**Consent:**

In granting this permission, I .....  
have fully understood this informed consent form thoroughly explained to me in English/Twi/Ga and have had the opportunity to discuss any concerns and questions. I fully understand the nature and character of my involvement in this research programme and any foreseeable risks and consequences. I understand I may refuse to participate in this project and I am free to withdraw my consent and terminate my participation at any time without any effect on me or my child. I also understand that I am free to refuse to answer any specific questions or items in the interview or questionnaire.

Signature/Thumbprint of Participant .....

Date .....



**Appendix II: Sample Questionnaire**

**Sanitation Factors Influencing the Occurrence of Diarrhoea in Children Under 5 years at Kpone-On-Sea**

This questionnaire is prepared for a dissertation for a Master of Public Health course. Please answer questions with all honesty. All information gathered from this interview will be kept strictly confidential.

Questionnaire Serial Number: 

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**Please fill in the blanks or circle the appropriate response where applicable.**

**IDENTIFICATION**

Date of Interview: 

--	--	--

Respondent ID (H/No): 

--	--	--	--

Name of Interviewer: .....

**PART I: SOCIO-DEMOGRAPHIC CHARACTERISTICS OF CARETAKER OF CHILD UNDER 5**

1. What is your age (years)? .....
2. What is your gender?
  - a. Male
  - b. Female
3. What is your relationship with the child in question?
  - a. Mother
  - b. Father
  - c. Grandparent
  - d. Aunt/Uncle
  - e. Other (please specify) .....
4. What is the highest level of education you have completed in school?
  - a. No education
  - b. Primary
  - c. JHS
  - d. SHS
  - e. Tertiary
  - f. Other (please specify) .....

5. What is your occupation?
  - a. Unemployed
  - b. Farmer
  - c. Fisherman
  - d. Teacher
  - e. Trader
  - f. Other specify .....
  
6. What is your average income level in Ghana cedis per month now?  
  
Please specify .....
  
7. How many hours per day do you allocate for caring for the child?
  - a. Less than 8 hours
  - b. 8 to 15 hours
  - c. 16 hours or more

**PART II: PRACTICES OF CARETAKER OF THE CHILD UNDER 5**

For questions 8-22, interviewer must ask question and circle the answer closest to the respondent's opinion.

8. How often do you wash your hands before preparing the child's food?
  - a. Always
  - b. Sometimes
  - c. Never (Skip to Q10)
  
9. Do you wash your hands with soap before preparing the food?
  - a. Yes
  - b. No
  
10. How often do you wash your hands before feeding the child?
  - a. Always
  - b. Sometimes
  - c. Never (Skip to Q12)
  
11. Do you wash your hands with soap before feeding the child?
  - a. Yes
  - b. No
  
12. How often do you wash your hands after visiting the toilet or latrine?
  - a. Always
  - b. Sometimes
  - c. Never (Skip to Q14)

13. Do you wash your hands with soap after visiting the toilet or latrine?
  - a. Yes
  - b. No
  
14. How often do you clean the feeding/eating utensils of the child?
  - a. Always
  - b. Sometimes
  - c. Never (Skip to Q16)
  
15. Do you wash the feeding/eating utensils of the child with soap?
  - a. Yes
  - b. No
  
16. How do you keep flies from landing on your cooked or left over foods?
  - a. Put in a refrigerator
  - b. Use a food cover
  - c. Put in the cupboard
  - d. Other specify .....
  
17. How do you usually give food to your infant or child?
  - a. by using cutlery like spoon
  - b. by using bare hands
  - c. both bare hands and cutlery
  - d. Other specify .....
  
18. How do you clean your nipples prior to breastfeeding your child?
  - a. wash them with soap and water
  - b. wash them with lukewarm water
  - c. clean with a cloth
  - d. do not wash them
  - e. do not breastfeed
  
19. How do you clean the feeding bottles being used by your child?
  - a. wash them with soap and water and boil afterwards
  - b. wash them with soap and water only
  - c. wash them with water only
  - d. do not bottle-feed
  
20. What kind of water do you give to your child?
  - a. boiled water
  - b. bottled/sachet water
  - c. tap water
  - d. water from a well
  - e. Other specify .....

21. What did you do the last time your child passed stools?  
a. threw them in the latrine                      b. put them in a dust bin  
c. left them around the house                  d. Other specify .....
22. What did you do the last time your child had diarrhoea\*?  
a. went to the health centre                      d. did nothing  
b. gave ORS    e. don't remember  
c. gave homemade fluids                         f. Other specify .....

**PART III: CHILD FACTORS**

23. What is the child's age? ..... years and ..... months
24. What is the gender of child?  
a. Male    b. Female
25. Do you know the weight of your child at birth?  
a. Yes     b. No (Skip to Q27)
26. If YES what was the child's weight at birth?  
a. Less than 2.5 kg    b. 2.5 kg or more
27. If NO what is your estimated weight of the child at birth?  
a. Very small  
b. Smaller than average  
c. Average or larger  
d. Don't know
28. What is the current weight of the child in kilograms? .....
29. What is the child's birth order?  
a. First order  
b. Second order  
c. Third order and above
30. Was the child breastfed in the first six months of life?  
a. Yes     b. No (Skip to Q32)
31. If YES was the child exclusively breastfed?  
a. Yes     b. No



40. Do you treat your water in any way to make it safer for drinking?

- a. Yes
- b. No (Skip to Q42)

41. If YES what do you usually do to the water to make it safer to drink?

- a. Boil
- b. Add bleach
- c. Strain through a cloth
- d. Let it stand and settle
- e. Other .....

42. Is the source of drinking water different from the source of water for other uses such as cooking or hand washing?

- a. Yes
- b. No (Skip to Q44)

43. If YES what is the current source of water available for other use such as cooking and hand washing?

- a. Private indoor pipe
- b. Community stand pipe
- c. Rainwater
- d. Well
- e. Other (please specify) .....

44. What is the total quantity of water available to your household daily for drinking and other uses?

- a. Less than 20 litres per head
- b. 20 litres or more

### **Human excreta disposal**

45. Do you have a toilet facility in the house?

- a. Yes
- b. No (Skip to 47)

46. If YES what kind of toilet facility do members of your household usually use?

- a. Flush toilet
- b. Pit latrine
- c. Other specify .....

47. Does the child in question use this toilet facility?

- a. Yes
- b. No (Skip to Q49)

48. Does the child visit the toilet facility with assistance?

- a. Yes
- b. No

49. What type of cleaning material is used for the child after defecation?
- a. Toilet tissue
  - b. Water
  - b. Other paper
  - d. Other specify .....

**Refuse disposal**

50. How do you dispose of refuse?
- a. Burn
  - b. Bury
  - c. Garbage bin
  - d. Other specify .....

51. Is there a refuse collection can or site available to the household?
- a. Yes
  - b. No (Skip Q52)

52. Where is this site located?
- a. In the dwelling
  - b. In the yard
  - c. Other (please specify) .....

**Waste water disposal**

53. Is there a drainage system for domestic waste water (eg bathroom and kitchen waste water) collection?
- a. Yes (Skip Q54)
  - b. No

54. If NO how do you dispose of waste water?
- a. Pour around the house
  - b. Other (please specify) .....

Thank you for your cooperation!

**Appendix III: Sample Observation Checklist**

**Sanitation Factors Influencing the Occurrence of Diarrhoea in Children Under 5 Years at Kpone-On-Sea**

To be filled by interviewer. Please make careful observations of the facilities and tick responses where applicable.

SPECIFIC INFORMATION	RISK
<b>A. Source Of Drinking Water</b>	
Specify source of drinking water .....	
1. Is there a latrine within 30 meters of the source?	<input type="checkbox"/> Yes <input type="checkbox"/> No
2. Is there any other source of contamination such as a refuse dump or farm within 30 meters of the source?	<input type="checkbox"/> Yes <input type="checkbox"/> No
3. Is there any pond of stagnant water within 2 meters of the source?	<input type="checkbox"/> Yes <input type="checkbox"/> No
4. Is there inadequate fencing such that animals are allowed around the source?	<input type="checkbox"/> Yes <input type="checkbox"/> No
5. Is the source opened/unprotected?	<input type="checkbox"/> Yes <input type="checkbox"/> No
6. If the source is covered is the cover dirty?	<input type="checkbox"/> Yes <input type="checkbox"/> No
7. Are there people bathing or washing around the source?	<input type="checkbox"/> Yes <input type="checkbox"/> No
<b>B. Toilet Facility</b>	
Specify type of toilet facility .....	
8. Are there any faeces on the walls, floor or seat?	<input type="checkbox"/> Yes <input type="checkbox"/> No
9. Is the latrine open such that faeces are accessible to flies and other animals?	<input type="checkbox"/> Yes <input type="checkbox"/> No
10. Is the pit opened?	<input type="checkbox"/> Yes <input type="checkbox"/> No
11. Is ventilation inadequate?	<input type="checkbox"/> Yes <input type="checkbox"/> No



12. Is there the absence of any hand washing (water and soap) facility?	<input type="checkbox"/> Yes	<input type="checkbox"/> No
<b>C. Refuse Disposal Facility</b>		
13. Is the refuse bin or pit opened such that flies and other animals can access the refuse?	<input type="checkbox"/> Yes	<input type="checkbox"/> No
14. Is the refuse bin or pit within 20 meters of any cooking area?	<input type="checkbox"/> Yes	<input type="checkbox"/> No
<b>D. Waste Water Disposal Facility</b>		
15. Is the drain left opened such that flies and other animals can access the waste water?	<input type="checkbox"/> Yes	<input type="checkbox"/> No
16. Is the drain clogged?	<input type="checkbox"/> Yes	<input type="checkbox"/> No
<b>E. Housing Conditions</b>		
17. Physical set-up of the house	<input type="checkbox"/> Mud house <input type="checkbox"/> Cement <input type="checkbox"/> Wooden structure	
18. Is the floor material of the house made of sand or earth?	<input type="checkbox"/> Yes	<input type="checkbox"/> No
19. Are there houseflies around the house	<input type="checkbox"/> Yes	<input type="checkbox"/> No
20. Is there any stagnant water that can serve as breeding areas for houseflies and other insects?	<input type="checkbox"/> Yes	<input type="checkbox"/> No
21. Is cooking area opened to allow flies and other animals in?	<input type="checkbox"/> Yes	<input type="checkbox"/> No
22. What is the flooring of cooking area made of?	<input type="checkbox"/> Sand <input type="checkbox"/> Wood <input type="checkbox"/> Cement Other specify .....	
23. Are there any animals or livestock in the house?	<input type="checkbox"/> Yes	<input type="checkbox"/> No

**Appendix IV: Sample In-Depth Interview Guide -Nursing Officer**

Sanitation Factors Influencing the Occurrence of Diarrhoea in Children Under 5 Years at Kpone-On-Sea

Interviewer code \_\_\_\_\_

Date \_\_\_\_\_

Venue \_\_\_\_\_

Time: from \_\_\_\_\_ to \_\_\_\_\_

**Name and role(s) of respondent in community:** \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

**Section A: Burden of diarrhoea in children under 5 years**

1. How serious a problem is diarrhoea in children under 5 years in this community at this time?

*Probes: Severity of child's condition, what proportion needs hospitalization, criteria for hospitalization, extent and sources of worry.*

2. What age-group of children suffers the greatest share of this burden of diarrhoea?

*Probe: Why do you think this is so?*

3. Can you please describe a typical case of diarrhoea you have seen in the past month?

*Probe for age of the child, socio-economic status of the caretaker and possibly water supply and housing conditions*

4. What clinical forms of diarrhoea in these children are presented to the health centre?

*Probe for the commonest form*

**Section B: Factors influencing childhood diarrhoea occurrence**

5. In your opinion what are the major causes of diarrhoea in children under 5 years?
6. What do you think is the contribution of sanitation factors to the occurrence of diarrhoea in children in the community?  
*Probe about contribution of water supply, waste disposal, housing sanitation conditions*

**Section C: Caretakers' perception of diarrhoea and education about diarrhoea**

7. At what stage of the disease do caretakers bring their children to the health centre for treatment?  
*Probes: why do they wait so long? What do they try at home first?*
8. Do you think caretakers have adequate knowledge about the causes of childhood diarrhoea and how to prevent its occurrence?
9. Are there any activities currently being carried out by this health center to educate caretakers on childhood diarrhoea?  
*Probe: if YES probe about activities such as hygiene education*

**Comments**

Thank you for answering all my questions. Is there anything else you would like to tell me about your experience with childhood diarrhoea in this community?

**THANK YOU VERY MUCH FOR TAKING TIME TO TALK TO ME.**

**Appendix V: Sample In-Depth Interview Guide - Environmental Health Officer**

Sanitation Factors Influencing the Occurrence of Diarrhoea in Children under 5 years at Kpone-On-Sea

Interviewer code \_\_\_\_\_

Date \_\_\_\_\_

Venue \_\_\_\_\_

Time: from \_\_\_\_\_ to \_\_\_\_\_

**Name and role(s) of respondent in community:** \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

**Section A: Access to Sanitation services**

1. Can you describe the sanitation services that are currently available to the people of Kpone?

*Probe for details of water supply, waste disposal services etc*

2. What factors in your opinion are influencing the use of the sanitation services available so far?

*Probe about the use of public latrines, solid waste disposal services etc*

**Section B: Extent of problem of sanitation**

3. What challenges is your outfit facing currently in terms of water supply and waste disposal in this community?

*Probe for the greatest challenge, bad practices (e.g. "free range", food handling, general hygiene etc) and reasons for these practices*

4. Can you in your opinion mention some of the health problems resulting from the bad practices mentioned so far?

*Probe about diarrhoeal diseases if not mentioned*

**Section C: Solutions to the problem of sanitation**

5. Are there any activities being carried out recently to improve sanitation in the community?

*If YES, probe for activities going on currently*

6. What do you think are the most effective channels for communicating information about sanitation?

*Probe for suggestions on how to reach caretakers of children especially*

**Comments**

Thank you for answering all my questions. Is there anything else you would like to tell me about your experience with this community as far as sanitation is concerned?

**THANK YOU VERY MUCH FOR TAKING TIME TO TALK TO ME.**

**Appendix VI: Sanitation conditions at Kpone-On-Sea**

**Fig 7.1: Children at a communal pipe at Kpone-On-Sea**



**Fig 7.3: Children defecation in the open at Kpone-On-Sea**



**Fig 7.2: Refuse disposal site at Kpone-On-Sea**



**Fig 7.4: Open defecation on the beach at Kpone-On-Sea**

