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DETERMINANTS OF FACTORS INFLUENCING HOUSEHOLDERS' ACCESS TO IMPROVED WATER AND SANITATION FACILITIES IN SELECTED LOW-INCOME URBAN AREAS OF ACCRA

BY:

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DECLARATION

I, **Ayisha Matuamo Mahama**, hereby declare that except for references to other people's work which have been duly acknowledged, this thesis is the result of my own research carried out at the Institute of Statistical, Social and Economic Research (ISSER), University of Ghana under the supervision of Professor Kwabena Asomanin Anaman (ISSER) and Dr. Isaac Osei-Akoto (ISSER).

This thesis has neither in whole nor in part been presented for another degree.

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DEDICATION

This work is dedicated to the Almighty Allah for making it possible for me to successfully complete this study and then to my parents, Mr. and Mrs. Mahama for their support and encouragement throughout this period. May Allah bless you.

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ABSTRACT

The urban population in Ghana keeps increasing with resultant pressures exerted on the resources of the nation and congestion created especially in slums or informal areas. These have caused much pressure on the few facilities especially in the areas of water and sanitation and have contributed to worsening urban poverty. This study analysed the factors influencing householders' access to improved water and sanitation facilities in selected low-income urban areas of Accra. The selected five (5) localities were Nima, Accra New Town, La, James Town and Bubuashie and were classified as migrant, mixed and indigenous communities. A systematic sampling method was used to select 1,500 households from 100 enumeration areas with 15 households selected from each enumeration area.

In order to address the objectives of the study, each of the dependent variables dealing with improved water and sanitation was reclassified into two categories using dummy variables. As such, 1 was used to represent householders with access to either improved water for drinking, improved water for other purposes or access to improved toilet facilities and 0 (zero) for unimproved sources of these facilities. Chi-square analysis was employed to establish whether there was statistically significant association between access to improved or unimproved water and sanitation facilities and selected socio-economic variables. Binary logistic regression analysis was also used to determine the factors which influenced households' access to improved water and sanitation facilities.

The results of the analysis of the survey data revealed that only (4.4%) of the respondents had access to improved drinking water while 34.7% had access to improved access to toilet facilities based on the definitions used in this research study. However, based on broader definitions suggested by WHO, respondents with access to improved drinking water were 40.7% and those with access to improved toilet facilities were 84%.

The statistically significant determinant of householders' access to improved drinking water was household income (wealth). However for access to water for other uses such as cooking, the statistically significant factors influencing the use of improved water were education, income (wealth) and location of the householder. Compared to migrants, indigenes and people from mixed areas were more likely to have access to improved sources of water for other purposes. The significant factors determining access to improved toilet facilities were education, income (wealth), location and gender. Indigenes and people from mixed background were more likely to have access to improved toilet facilities as compared to the migrants. Males were less likely to have access to improved toilet facilities as compared to females.

Some of the policy recommendations suggested based on the findings of the study included the need for government to upgrade the living status in the rural areas in order to minimize the rapid rural to urban drift which tends to cause so much pressure on the few existing facilities in the urban areas. Educational programmes on hygiene and public health as well as creation of more job opportunities are crucial in empowering the population to understand and contribute to the improvement of water and sanitation in the country. Religious leaders should also use their platforms to persuade their followers to change their "negative" behaviours and attitudes concerning environmental sanitation to help advance the development of the country.

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LIST OF ABREVIATIONS

AMA	Accra Metropolitan Assembly
CDF	Cumulative Distribution Function
CEM	Country Economic Memorandum
EA	Enumeration Area
FRAMICS	Fourth Round Accra Multiple Indicator Cluster Survey
GDP	Gross Domestic Product
GHS	Ghana Health Service
GLSS	Ghana Living Standards Survey
GNP	Gross National Product
GSS	Ghana Statistical Service
GWC	Ghana Water Company
ISSER	Institute of Statistical Social and Economic Research
JMP	Joint Monitoring Progress
LPG	Liquefied Petroleum Gas
LPM	Linear Probability Model
MDG	Millennium Development Goal
MLGRD	Ministry of Local Government and Rural Development
NGO	Non-Governmental Organization
NHIS	National Health Insurance Scheme

PURC	Public Utility Regulatory Commission
SPSS	Statistical Package for Social Sciences Software
UNDP	United Nations Development Programme
UNICEF	United Nations Children's Fund
VIP	Ventilated Improved Pit
WHO	World Health Organization

CHAPTER 1

INTRODUCTION AND PROBLEM STATEMENT

1.1 Background

Urbanization which connotes rural-urban drift is a growing global phenomenon that is more pronounced in developing countries. More than half of the world's populations live in urban areas with a higher urban growth occurring in Asia and Africa (Penrose *et al.*, 2010). For instance, whereas the urban growth rates of two of the world's largest cities (New York and Tokyo) are below 1%, the growth rates of many African cities including Nairobi, Lagos and Accra are over 6% per annum (Todaro and Smith, 2006).

This increase in human population is even more intense in informal urban settlements. About 71% and 40% of urban dwellers in Sub-Saharan African (SSA) and Asian countries respectively live in informal settlements as compared to only about 6% of urban dwellers living in such areas in the developed nations (Hove, 2003). Rural-urban migration is fuelled by availability of better quality services such as education, health, and job opportunities in cities (Rashid, 2009). However, in developing countries such as Ghana, movement of people to cities, which should serve as a catalyst for socio-economic development, tends to impose a lot of stress on the few available facilities in the cities especially those related to housing, sanitation and water. Additionally, the rapid rate of urbanization in the midst of slow progress in the provision of water and sanitation facilities has led to the inability of the country to keep pace with meeting the demands of the population.

Access to both water and sanitation is a major developmental challenge in developing countries. Almost 1.1 billion people worldwide do not have access to clean water and over twice these numbers, more than 2.5 billion, lack access to basic sanitation facilities. More than 80% of these 2.5 billion people are in Asia and Sub-Saharan Africa as documented by World Health Organization (WHO) and the United Nations Children Fund (UNICEF) in 2009.

In a WHO 2010 study, it was reported that only 35% of the urban population in Sub-Saharan Africa (SSA) have access to a piped water connection in their household (Zuin *et al.*, 2011). In another related report by UN-HABITAT, over the period, 1990 to 2004, the proportion of people without access to safe water in urban areas in SSA countries either increased or remained unchanged in more than half of the region. As at 2004, only six countries had achieved the Millennium Development Goal (MDG) for water and only seven more countries were expected to achieve the target by 2015. Over 65% of SSA countries (26 out of 39) were not likely to meet this MDG by 2015 because their access rates grew much more slowly than was required to achieve the target (Dagdeviren, 2011).

1.2 Problem Statement

Ghana, like many countries in Sub-Saharan Africa, is also experiencing high rate of movement of people from rural to urban areas. As documented by the Ghana Statistical Service (2012) using data from the 2010 National Population and Housing Census, the urban population was higher than the rural population. About 50.9% of the population was classified as urban compared to 49.1% as rural in 2010 (Ghana Statistical Service, 2012).

A worrying aspect of the rapid demographic shift is the worsening of urban poverty in the major cities such as Accra as reported by the Ghana Statistical Service in 2007 based on the Ghana Living Standard Survey (GLSS) 5 conducted over the period, 2005 to 2006. According to the GLSS 5 report, there was general improvement among populations living below the poverty line in the country. This share of the population classified as poor declined from 51.7% in 1991/1992 to 28.5% in 2005/2006. However, the situation rather worsened in some urban areas of the country especially in the Greater Accra region where the proportion of people living below the national poverty line increased by 7% between 1998/1999 and 2005/2006 (GSS, 2007). The Greater Accra region which holds the seat of national power is particularly vulnerable to ethnic, security and political instability tensions related to rising urban poverty.

Owusu and Lawerence (2010) argue that majority of the individuals and families who come to the urban cities are denied their expected opportunities as most of their dreams are left unfulfilled due to failure of the urban economies and local authorities to provide infrastructure and services to serve the ever increasing populace. For instance, rents are too expensive making decent housing unaffordable for the urban poor. The urban poor in Ghana are forced to live in environments characterized by poor housing conditions, overcrowding, increasing population growth, insecure residential status, lack of or inadequate access to safe water and sanitation services, poor access to health care and poor security (Penrose *et al.*, 2010).

The need to provide access to good quality water and sanitation services to low-income urban residents cannot be overemphasized. Many governments in Sub-Saharan African countries concentrate their priority on middle and upper income households to the detriment of the poor (Kähkönen, 1999) mainly due to the political power of the middle and upper classes. The absence of proper water and sanitation facilities and services come with associated problems

with the major one being the creation of a network of increased ill-health through the transmission of pathogen-causing diseases such as malaria, diarrhoea, skin diseases, intestinal worms, acute eye infections and typhoid fever. Reither and others (2007) estimated that about 16% of deaths in children younger than five years are directly attributable to diarrhoeal diseases in Africa. This burden on society caused by early deaths of children is very much applicable to Ghana. For instance, malaria, upper respiratory tract infection (URTI), diarrhoea, skin disease and injury are reported as the leading causes of out-patient visits with malaria accounting for about 40% of childhood and under five mortality (GSS, 2005).

These preventable largely acute diseases contribute to increasing substantially the financial health expenditure of government. For instance, the amount of money paid to health care providers of the National Health Insurance Scheme (NHIS) increased from GHS 241.836 million in 2009 to GHS 394.270 million in 2010 (Ghana Statistical Service, 2012). In addition, the Water and Sanitation Programme (2012) indicates that Ghana loses about GH¢420 million annually due to more time taken to search for water, loss of productivity and the medical costs of treating water and sanitation related diseases (ISSER, 2013). These expenditures could have been reduced if efforts were concentrated on the reduction of the root causes of these preventable diseases especially those related to water and sanitation through the adequate supply of improved water and sanitation facilities.

The worst aspect of these complications is that it is these same urban poor who normally have the least access to proper health care delivery services due to high cost involved in accessing proper medical and health facilities (Nwaka, 2005). The urban poor also tend to suffer the extra burden of the increases in cost of living, lower income earning potentials and riskier life especially the women and children (Bosch *et al.*, 2001).

In the Ghanaian context, major cities such as Accra, Kumasi and Tamale continue to experience an increasing growth in population which has not been matched by a corresponding increase in social services including improved water and sanitation facilities. This imbalance has led to increased poverty among the population especially the poor in Ghana as measured by some indicators. For example, according to the 2010 Population and Housing Census (PHC) report published by the Ghana Statistical Service in 2012, the proportion of the population using public toilet facilities, considered to be unimproved, increased from 31.4% in 2000 to 34.6% in 2010. Further, in 2010, the proportion of the population with no access to toilet facilities and who practised open defecation at beaches, fields and bush remained high at 19.3% just slightly below the 2000 figure of 20.2%.

The 2010 PHC report further show worsening sanitation conditions among the urban poor of which Greater Accra Region, the capital town of Ghana is no exception. For instance, due to the ban on the use of pan latrines, the National figure shows a significant reduction in the use of pan latrines from 4.0% in 2000 to 0.7% in 2010. This notwithstanding, Greater Accra in 2010 recorded the highest percentage (2.3%) of population using the pan latrines as a means of waste disposal. Again, though the national average recorded 10.9% as population who dispose off liquid wastes through gutters, Accra recorded about 18.5% of its population resorting to this method (Ghana Statistical Service, 2012). The 2010 PHC Report also indicated that slightly over one-third of the population of the Greater Accra region, the seat of the national capital of Ghana used public toilet facilities while 8.2% of the population in that region practised open defecation in the bush, fields and beaches. With regards to solid waste, it is estimated that five of the country's largest cities (Accra, Kumasi, Sekondi-Takoradi, Tamale and Tema) are the highest

generators of solid waste and about 85% of their refuse generated is left uncollected (ISSER, 2013).

Given the relatively high economic growth of the country over the period from 2000 to 2010, which was among the highest in Africa and the world, and with this growth heavily concentrated in the Greater Accra region, it remains a mystery why there is still the persistence of relatively high number of people in the region with unimproved water and sanitation facilities. There exists a continuing challenge to seek information based on research evidence that can be used to address the water and environmental sanitation problems of the urban poor. It is in this regard that it has become imperative that more research work is undertaken to analyze and understand the water and sanitation problems facing the urban poor especially those factors that influence access of the urban poor to improved water and sanitation facilities.

1.3 Objectives of the Study

The main objective is to determine the factors influencing householders' access to improved water and sanitation facilities in selected low-income urban areas of Accra. The specific objectives are as follows:

1. To determine the level of access to improved water and sanitation by households in the selected low-income areas of Accra region.
2. To determine the factors influencing householders' access to improved water and sanitation facilities in the selected low-income areas.

1.4 Research Questions

1. What is the level of access to improved water and sanitation by households in the selected communities?
2. What are the factors influencing these households' access to improved water and sanitation facilities?

1.5 Research Hypotheses

Based on the objectives listed above, the following hypotheses are suggested.

1. The level of access to improved water and sanitation is low for the selected low-income urban households.
2. Access to improved water and sanitation facilities by households depend on socio-economic factors such as education, gender, location, religious status and income status and migrant status.

1.6 Justification of the Study

Safe water and sanitation are necessary for the survival of human beings. They have numerous benefits related to increased well-being, cost reduction, personal dignity and privacy as well as time savings for households. Many urban areas in Ghana continue to experience unprecedented growth thereby creating problems related to limited and inadequate access to safe drinking water and adequate sanitation facilities. This unbalanced growth poses great danger to the health of

residents especially among the urban poor who reside in informal dwellings that often lack proper water and sanitation facilities. Therefore, more attention needs to be paid to ensure safe and quality sanitation. Health needs of the population need to be satisfied so that the human and natural resources of the country can be efficiently developed in a sustainable manner over the long-term period.

The health and rights of people especially those in low-income and informal settlements have become key developmental issues in the 21st Century as majority of the urban population reside in these areas (Rashid, 2009). The existing literature tends to focus on major cities, paying less attention to small and mid-sized urban centers (Sverdlik, 2011). The findings of this study which focuses on a mixture of small urban and peri-urban areas in the Greater Accra region can provide useful information on the water and sanitation problem of marginalized populations.

The findings from the study can be beneficial to stakeholders such as Ministry of Health, Ministry of Local Government and Rural Development, Accra Metropolitan Assembly and the Town and Country Planning Department to help them develop pragmatic and sustainable solutions to deal with the water and sanitation problem that ensures environmental sustainability, reduction in income inequality and the empowerment of the urban poor to move them out of endemic poverty.

Concerns about issues of water and sanitation have been raised at both the national and international levels. The Millennium Development Goals (MDGs) emphasize the need to improve the provision of water and sanitation services especially among the urban poor. The UN/UN-Habitat (2009) report reiterates the need for the supply of water and sanitation services that ensure the attainment of the MDGs. The report asserts that the provision of safe drinking

water leads to improvement of people's health and saves time, which consequently helps to improve livelihoods. Improved sanitation protects the poor from socially and physically degrading surroundings, health risks and exposure to dangerous environmental conditions thereby reducing child mortality, pre and post-natal risks due to blockage in the transmission of pathogens which cause sanitation-related diseases such as diarrhoea, malaria and typhoid fever.

This study contributes to the provision of the evidence-based information on the challenges of water and sanitation services of marginalized and low-income urban people living close to affluent areas of a major city. A limitation of this study is the focus on only three types of improved water and sanitation facilities–improved drinking water, improved water for other domestic uses and improved toilet facilities.

1.7 Organization of the Study

The introduction and problem statement as well as the objectives, hypotheses and justification of the study constitute the Chapter 1 of the thesis report. Chapter 2 provides a summary of the literature reviewed on the various thematic areas while Chapter 3 dwells on the profile of the study area and the methodology used for the study. The results are presented in Chapter 4 followed by the conclusions and recommendations in Chapter 5. The references and appendices are presented at the end of the thesis report.

CHAPTER 2

LITERATURE REVIEW

2.1 Access to Improved Water

The importance of water cannot be overemphasized as it is used for many purposes such as domestic household chores, drinking and for non-domestic purposes. The 1977 Mar Del Plata Action Plan adopted by the UN General Assembly enshrines access to water as an essential human right. This human right relating to water includes having access to drinking water in adequate quality and quantities. The rights of access of everyone to drinking water supply and adequate sanitation services are now enshrined as fundamental human rights. Exclusion of anyone from access to these services due to poverty or place of habitation is a violation of their human rights (Gronwell, 2008). According to United Nations Development Programme (UNDP) 2006, a person not having access to at least 20 litres of clean water each day has his or her fundamental human rights violated.

Water and sanitation access are intertwined as they are interrelated. It is only through ensuring safe sanitation that we can attain safe water supply especially water from ground sources (Christine *et al.*, 2006). Without water, flush toilet which is considered one of the best methods of excreta disposal, is of limited use or unsuitable for poorer households and water-scarce areas (Mfatu, 2009).

Though water supply coverage in developing countries has generally improved, there are still higher proportions of the population without reliable access to safe water. Even though, governments are faced with many challenges such as finance in improving peoples' access to these services, a major problem that has hindered their ability to cater for the water and sanitation services is the rapid increase in the numbers of people in urban areas which has led to deepening of the poverty situation in many cities (Kurian and McCarney, 2010).

Mudege and Zulu (2011) posit that the reduction in access to safe drinking water is partly attributed to the increasing pressure on the relatively few available facilities. In Kenya for instance, there has been a continuous decrease in access to quality water. The ratio of piped to unpiped households has decreased from about 8:1 in 1967 to 2.6:1 in 2005 due to pressure on piped water facilities in municipalities. The study further reveals that the problem with access is not just because of scarcity but also due to its unequal distribution and the marginalization of people in informal areas and settlement in development plans.

In 1993, basic access to water according to the World Health Organization was defined as having 50 litres per person per day (Smith and Hanson, 2003). However, WHO in 2003 redefines basic access to water to denote having access to average quantities not below 20 litres per capita per day and with a total collection time of five to 30 minutes (Howard and Bartram, 2003). This notwithstanding, for one to be able to do laundry, get enough to drink, cook and ensure basic hygiene, then about 30 - 40 litres of water per capita per day are required (Bartlett, 2003).

UN-Habitat (2009) suggests several factors that are required for the achievement of minimum level of safe and affordable drinking water. These are (1) the households must have 20 litres of water per person per day (2) the drinking water must not cost more than 10% of the total household income and (3) it must be available without extreme effort which is taken to mean less than one hour per day for collection of water.

Improved water source according to the Joint Monitoring Progress (JMP) (2008) is a source of water designed such that it is devoid of any contamination especially from faecal matter (Osman and Khan, 2011). The World Health Organization (WHO) defines improved sources of drinking water to include water piped in homes, piped into a yard, piped into a neighbor's house, rainwater, boreholes and wells. This notwithstanding, studies by McGarvey and others (2010) and Adank and others (2011) indicate that water from boreholes, wells and rivers are more often than not contaminated with pollutants such as bacteria, feacal matter and chemicals hence should rather be considered as unimproved sources (Obeng-Odoom, 2012). Therefore based on this consideration in Ghana, only pipe borne water to homes and within the locality and rainwater are considered improved sources of water especially for drinking.

The Social Policy and Strategy for Water Regulation of the Public Utility Regulatory Commission (PURC) (2005) in Ghana defines the urban poor as those without direct access to regulated piped water supplies and depend on secondary and tertiary suppliers as well as buying water using the bucket from external agencies. According to Plummer (2002a), as cited in Franceys (2008), the degree of poverty affects households' priorities such that the 'very poor' have no money at all to spare for water services, the 'middle poor' prioritize water over sanitation, while the 'better off poor' cut back on water service expenditures only in emergencies.

In a focus-group discussion study conducted in four informal settlements in Nairobi, Kenya by Amuzunyu and Taffa (2004), it was found out that not only did community members have to travel long distances to collect water, some of the landlords in the community contributed to limiting their access to water as these landlords rationed water such that it was only available on specific days of the week and at specific times. Also, the study found that, the cost of water paid by residents without piped connections were higher than what households with piped water paid.

In a study conducted in Malawi, it was found that more than half (53%) of the household population resorted to buying of water from kiosk while only about 26.2% had their own household connections. It was also found from the study that though there was physical availability of safer water, it was out of reach for most of the urban poor due to variations with regards to cost of water per litre. Whereas some paid about three Malawi Kwacha for 20 litres of water, others bought the same quantities for more than four Malawi Kwacha. The study emphasized that it would therefore be misleading to use only availability of water to measure access because there existed other factors that indicated the quality of access of which distance was an important one (Mfatu, 2009).

Franceys and Gerlach (2008) assert that subsidizing water normally is to the disadvantage of the poor since most of them are not connected to the formal piped networks but rather rely on expensive intermediary vendors who charge exorbitant prices for service delivery. By so doing, the poor end up paying five, ten or even one hundred times the price paid by the rich for same quantity of water and so are less able to meet other needs such as school fees and good nutritional value.

The issue of differential prices charged for same quantities of water is similar in the Ghanaian context as the urban poor who normally rely on vendors or tankers are charged three to 15 times the normal utility price as reported by Franceys and Gerlach (2008). Further those in compound houses are also victims of higher water rates as tenants are made to pay about 300 old cedis for 17-liter bucket while the normal rate should have been 100 old cedis per the bucket. Aside these, the study also found out that while the low-income households use about 56 litres per person per day, the high-income households use about twice the quantity (120 litres) per person per day (Franceys and Gerlach, 2008).

In both urban and peri-urban areas of Ghana, a common observation is that relatively rich people have constructed their houses near piped water delivery networks of the government-owned Ghana Water Company (GWC) allowing them direct access to subsidized piped water from (GWC). Rural villages and poorer urban communities are often served by the government through the Community Water and Sanitation Boards which charge residents of these poor communities several times the rate of water delivery to affluent areas serviced by GWC. Thus in 2013 at Ayi Mensah, a very poor suburb of Accra, residents paid about 2.75 Ghana cedis per kilo-litre of water accessed through the Kweiman-Danfa Community Water Board. This was in contrast to the payment of 0.85 Ghana cedi per kilo-litre by affluent and middle class customers of GWC living in Adenta Municipality which is about five kilometres from Ayi Mensah.

Limiting access to water to mean only coverage is not sufficient enough to depict the true picture of Ghana's situation. Rather, access to water should be looked at by considering the quality and reliability. Quality should ensure that the drinking water is safe such that there are no pollutants or chemicals in it while reliability considers regular flow of water. According to a survey by World Bank, 2010, about 46% of households in Ghana with piped water connection rarely had

their pipes flowing while about 5% of the households had never had piped water (Obeng-Odoom, 2012)

2.2 Access to Sanitation (Toilet Facilities)

Sanitation encompasses maintenance of safe and hygienic environment within which human beings live and work. With specific reference to toilet facilities, sanitation refers to the process of ensuring safe human excreta disposal such that it does not lead to disease affecting other people or that it does not cause harm to the environment (Franceys and Gerlach, 2008). According to WHO, access to sanitation is having adequate excreta disposal facilities capable of preventing human, animal and insect contact with excreta (Tumwine *et al.*, 2003).

Mensah (2002) defines sanitation as the state of cleanliness of a place, a community or a people. He posits that it relates to the quality of life aspect of human health as determined by physical, biological, social and psychosocial factors of the environment. As such the theory and practice of assessing, controlling and preventing those factors in the environment is crucial as it can adversely affect the health of present generation and that of the future. In this regard, it is important for governments to provide improved sanitation facilities so as not to compromise on the economic progress of the nation.

Though it is generally acknowledged that the poor have limited access to improved water, access to improved forms of sanitation is said to even be more limited than access to clean water. Twice the numbers without access to clean water lack access to proper sanitation (Khalfan, 2007). Meanwhile access to improved sanitation has both direct and indirect impacts on human health in

the sense that it can lead to reduction of disease transmission and also reduce the pollution hazards affecting drinking water supplies.

Improved sanitation facilities ensure the separation of human excreta and urine from human contact. These facilities are flush or pour-flush toilet facility, ventilated improved pit (VIP) latrine, pit latrine with slab and composting toilet. Unimproved sanitation is defined as sanitation that involves unhygienic disposal of waste where there is no separation of human excreta from human contact. These include pit latrine without a slab or platform, hanging latrines and bucket latrines. It also includes improved facilities which lack adequate disposal, such as pour-flush toilets that discharge directly into open drains, ditches or other water-bodies (WHO/UNICEF 2008).

Sanitation is crucial and important in curbing if not eliminating many diseases and as such serves as a foundation for good human health. Not only does investment in it leads to protection of other sectors, but it also enhances the dignity of oneself. Notwithstanding these, the sanitation coverage worldwide is still inadequate especially in Sub-Saharan Africa. While the sanitation coverage of South-Eastern and Eastern Asia increased by about 17% from 1990 to 2006, that of Sub-Saharan Africa improved by only 5% within the same period (WHO/UNICEF, 2008).

A comparative analysis of the sanitation coverage in Ghana showed that, though there have been some improvements of about 10.8% increment of households with safe sanitation from 1997 to 2006 (Awuah *et al.*, 2008), the current environmental sanitation situation still leaves much to be desired. For instance, Garmendia and others (2004) found than more than two-thirds of poorest households in Accra share their toilet or latrine facilities with more than 10 other households within their neighborhood. With regards to waste water, the 2010 Population and Housing

Census report indicates that the proportion of households who pour their liquid waste either onto the street or outside their homes is about 28.1% while 18.7% of households throw their waste into the gutters (Ghana Statistical Service, 2012).

Even though the rural areas tend to have lesser quality sanitation facilities despite the high population who reside there, sanitary conditions and its effects are far worse in urban areas due to ever-increasing population and overcrowding (WHO/UNICEF, 2010). In support of this, Garmendia and others (2004) indicate that though the rural coverage is much lower, the pressure on the urban areas is severer due to rapid rural-urban migration hence the health effects in the urban areas are worse than those of rural areas. A clear example is overcrowding and improper housing settlements in densely populated cities like Accra and Kumasi which have led to the occurrence of extreme flooding in many areas due to house construction near river sources.

The quality of sanitation facilities has been identified as one of the significant determinants of incidence of diarrhoeal diseases. In urban Brazil for instance, it was realized that apart from the age of children (under two), the lack of sanitation facilities was a significant contributor to diarrhoea. Also, infants in households where soak pits were adopted as a means of liquid waste disposal were 60 per cent more likely to die than households where their toilet facilities were connected to sewer systems (Bartlett, 2003).

2.3 Determinants of Households' Access to Water and Sanitation Facilities

2.3.1 Income

Smith and Hanson (2003) establish that household income is one of the main determinants of access to water and sanitation facilities. From their study conducted in Cape Town, South Africa, households with lower incomes (below 800 rands) have limited opportunities to improve their water and sanitation conditions. Similarly, UNICEF estimates that households in the lowest wealth quintile are 5.5 times more likely to lack improved water access and 3.3 times more likely to lack adequate sanitation, compared with households in the highest wealth quintile in the same country. Also, the worst impact of the burden of poor access is normally borne by women and children. This is because they are normally the primary care-givers and responsible for the majority of water collection. Not only do they sacrifice time and education to collect water, they are markedly affected by sanitation-related diseases (Christine *et al.*, 2006).

Bosch and others (2001) also indicate income levels of households as among the factors that determine their access to water and sanitation facilities and services. This is because, the low-income groups are hardly able to afford high connection fees to piped water and hence limit their connectivity. Also while the higher income groups can afford to buy more and are also able to afford private alternatives in times of shortages these may be too expensive for the urban poor as they barely are able to meet the three basic needs (food, water and shelter). In Ghana, low-income communities who depend on public piped water receive less water and face greater shortages than high-income communities because the higher income communities have higher purchasing power than the former, Stephens (1996) as cited in Howard and Bartram (2003).

Another determinant of access to water is related to how equitable the facility is distributed. Even though there could be a general increase in access to water, there is normally inequitable distribution as distribution of piped water normally tends to favor high-income neighborhoods to the detriment of poor neighborhoods. In a 2010 World Bank survey of Ghana, it was revealed that only about 57% of households with income levels below 100 Ghana Cedis (GHS) per month have piped connections in their homes while in contrast, about 83% of households with income levels between GHS 1001-GHS 2000 per month have piped water connections in their homes. Also, according to the Ghana Statistical Service (2007), about 43% of households in the highest income quintile classification have piped water connections as compared to only 18.5% of households in the lowest income quintile classification (Obeng-Odoom, 2012).

Though there is said to be a direct relationship between wealth and coverage levels of water and sanitation such that higher income groups have wider coverage than lower income earners, there are exceptions depending on how a country prioritizes its public policies. Countries with high priority for human development irrespective of their income levels improve access to water and sanitation for their population while there are some with high income levels and still lag behind in the provision of these facilities. For instance, Pakistan and India spend 47 times and eight times more per capita on military budget than on water and sanitation facilities respectively (UNDP, 2006).

2.3.2 Location and Distance

Though the urban areas generally tend to have better access to water and sanitation facilities and services, urban households in slums or informal areas are more likely to have limited connectivity. This is because expansion of piped water to poor householders' especially those in slums are difficult due to the haphazard nature of their settlements. More often than not the water and sanitation needs of poor urban communities are hardly incorporated into urban and regional planning (Bosch *et al.*, 2001).

Franceys and Gerlach (2008) indicate that though most of the urban poor are housed in slums, many of such areas are often denied access or face cumbersome administrative procedures when it comes to connecting them to official water sources partly because of lack of security guarantees for land and pipelines as well as the problems of affordability. Though utility prices are cheaper for those connected to the water systems, most of the poor are denied access because they lack formal property rights to where they live. Their places of residence serve as a barrier to getting access to these facilities because of undeveloped infrastructure networks. This is because in places where road accessibility for instance is in poor conditions it implies difficulties in the removal of waste. Hence, it becomes very difficult for households in these areas to get connected to these services (UNDP, 2006).

Krantz (2005) in a study to determine the routine of households in a process of changing water and sanitation arrangement establish that older people use less water as compared to the younger generation with teenagers being the highest users as they bath often and also have lots of laundry to wash. Carlsson and others (2002), as cited in Krantz (2005), also establish that though women

give more priority to issues regarding sanitation than men, the latter have better water saving habits than women because they shower on fewer occasions and for shorter periods as compared to women.

In a related study by Howard and others (2003), it was revealed that distance is a crucial factor in determining access to water and sanitation facilities. The further away the source of water is to a household, the lesser amount of water consumed. For instance, in areas where people walk for more than one kilometre or spend more than 30 minutes for collection of total water, the per capita water use drops to about five to 10 liters per day. At that level of service, it becomes very difficult to meet adequate hygienic standards. This notwithstanding, in the urban areas, a major deterrent factor may rather be time taken to get water and not the distance as more people are most likely to reduce consumption of water if they have to walk shorter distances but have to queue for longer hours to draw the water (Bosch *et al.,* 2008).

Osman and Khan (2011) suggest that the amount of time involved in getting water is probably more important than the distance covered to the water source as a determinant of access to water. This is because, there are some areas where scarcity of water is so severe that it takes a longer time before an individual fetches the water than the distance covered to the water source. For example, in a study conducted in Mueda in Mozambique, women spend about two hours to get to a water source and spend about three hours to queue for the water due to the relative scarcity of available water for the people.

Studies by Ako and others (2010) reveal that the further away a water source is from a household, the more time spent in sourcing water. When householders have to travel for about three to 30 minutes to get drinking water, then they are able to meet their daily requirements of about 15-25 litres per person per day. However, they tend to compromise on drinking water if they have to spend beyond 30 minutes to get access to the water. In Lesotho, it was revealed that about 25% of households spend about two and half hours in collecting water while majority of households in East Africa and North Cameroon spend close to five hours and six hours respectively per day collecting water for household needs.

Howard and Bartram (2003) establish that average amount of water a household consumes depend on the location of the water source. Those who have water piped into their homes consume average quantities of about 155 litres per person per day. However, those whose water is supplied through a yard decrease consumption to about 50 litres per person per day while those whose water source is outside the home further reduce their daily average consumption level.

Emphasizing the issue of location as a determinant, Bartlett (2003), indicates that in Burkina Faso mothers with piped water within their homes are three times more likely to practise safe hygiene as compared to those whose sources of water are outside their compounds. Similarly in urban Brazil, householders who resort to using public standpipes were five times more likely to experience infant death than households with water piped to their homes.

Hygiene levels maintained by households are sensitive to the service level. Households with, water piped into their homes tend to use more water for personal hygiene while those who resort to using water sources outside their homes, use lesser quantities for personal hygiene. For example, in studies conducted in Tanzania, Kenya and Uganda, households with water

connection piped within their homes use about 16.3 litres per capita for washing dishes and clothes and 17.4 litres per capita for bathing while those whose sources of water are outside homes use an average of 6.6 litres per capita for washing dishes and clothes and 7.3 litres per capita for bathing (Howard and Bartram, 2003). Hiles and Brown (1997) also indicate that those with piped water supply and proper installation demand far more water than those without piped connections to their homes.

In a study by Mercado and Kjellstorm (2008) to determine the social determinants of health equity in urban settings, it is revealed that the burden of inadequacy of water and sanitation is borne by women and children. Apart from the fact that most of them without toilet facilities in their households have to travel far distances to ease themselves, they also delay their sanitary needs during the day time until night due to modesty and unavailability of water. According to Bartlett (2003), the farther children have to travel to search for water, the more calories they burn and hence have less amount of energy left to undertake other activities in the homes. Further, they are made to carry heavy containers in order to get more water. These can cause some physical deformities and affect the growth of their bones. Jain and Singh (2010) indicate that with regards to the women, the more time spent in search and collection of water, the lesser the time available to cater for other domestic needs such as cooking, care for children and pursuant of other income-earning activities.

2.3.3 Education

Aside location and distance, educational attainment also determines one's access to water and sanitation facilities. Lack of or low level of educational attainment serves as a great barrier to empowerment. The lesser the educational attainment of an individual, the more he or she has limited opportunities to demand better facilities from the authorities as he or she is powerless (Bosch *et al.,* 2008).

Lack of or inadequacies of water and sanitation facilities also tend to affect the education of children especially girl child as the burden of water collection is borne by them. More often than not, the number of hours spent in collecting the water interferes with their school attendance. Schools with poor sanitary and toilet facilities further discourage children especially the girl child from going to school regularly which consequently affects their performance and perpetuate the vicious cycle of illiteracy and poverty (Bartlett, 2003).

2.4 Health Effects of Low Income Households

The goals of human development as indicated by improved education and health access rely mainly on sufficient improvement in the access to quality and quantity of water and sanitation services. According to Brenneman and Kerf (2002), as cited in Garmendia and others (2004), there is a strong relationship between improvement in water and sanitation infrastructure and health outcomes. Their findings indicate that improvement in these infrastructure lead to a significant reduction in water and sanitation-related diseases among many households. In a study by Jain and Singh (2010) to explore the effects of water crisis, they indicate that 80% of diseases

in developing countries are as a result of the use of contaminated water and this factor tends to claim more lives than weapons used during wars. As such they conclude that the government intervention with greatest impact on public health and national development is ensuring adequate provision of safe drinking water and proper disposal of human excreta.

In situation where there is lack of access to water, sewage or solid waste management systems, there tends to be severe effects on the health of the population and the health costs in dealing with these impacts are huge and contribute to the draining of a country's financial resources. For instance, a million or more infants still die each year from diseases related to inadequate provision of water and sanitation, especially among low-income urban households (United Nations, 2011). Many pathogens ingested into food and water tends to contaminate them leading to many diarrhoea-related illnesses as well as cholera, typhoid and dysentery. People suffering from these diseases also face malnutrition and combined with other vulnerable diseases weaken their immune systems (Wilson and Bond, 2007).

In a report by Aramayo and others (2009) it is established that about 94% of the diarrheal burden of disease is attributable to environment, and is associated with risk factors such as unsafe drinking water, poor sanitation and poor hygiene. Also, a study by Macassa and others (2006) among infants in Stockholm indicates that the incidence of diarrhoea cases is reduced greatly at places where running water and hygienic latrines are provided. Again, Macassa and others (2004), as cited in Metwally and others (2007) indicate that children who stay at places with no toilet facility or where their source of water is from a well stand a higher risk of death as compared to those who live in areas with pipe borne water and flushing toilet facilities.

Govender and others (2011) indicate that unsafe disposal of human excreta by households lead to high presence of pathogens in the environment. In support of this assertion, Khalfan and others (2007) found that safe disposal of excreta is one of the strongest determinants of child survival in the sense that the incidence of infant death can be reduced by more than 30% with the presence of a flushing toilet in the house. Also the presence of safe and adequate water and sanitation services reduce other illnesses or diseases such as measles and pneumonia and contribute to a reduction in maternal mortality during childbirth.

Aside these, the number of hours lost due to illnesses resulting from poor access to water and sanitation facilities have severe consequences, both for the productivity of the labour force and overall socio-economic development. Greater economic losses from low quality water and toilet facilities are experienced in poorest countries especially those in Sub-Saharan Africa. This loss of about 5% of its Gross Domestic Product (GDP) or about 28.4 billion dollars is higher than the aid flows and debt reliefs received by these countries (UNDP, 2006)

In Ghana, the Country Economic Memorandum (CEM) (2007) indicates that the impact of poor environmental sanitation on other service sectors especially the food and hospitality industry affects tourism, one of the major sources of foreign exchange earnings for the country. This leads to a reduction of the Gross National Product (GNP) (MLGRD, 2010).

2.5 Safe Water and Sanitation as a Means of Poverty Reduction

It is generally assumed that the more urbanized a country, the higher the average life expectancy and the literacy rate, as well as its access to basic services and infrastructure. This has resulted in many concluding that the urban areas are better off than the rural areas. However the State of the World's Cities Report 2006/2007 reports that the urban poor or slum dwellers are worse off compared to their rural relatives (Gronwell, 2008). This assertion is supported by United Nations, (2011) which indicates that despite the urban advantages conferred by the proximity to modern health centres, the health risks confronting the urban poor lead them to have more degrading lives often due to their access to congested, poorly maintained water and sanitation facilities.

The urban poor are noted as those persons living in low-income zones, such as slums and squatter areas, whose incomes do not permit them adequate access to basic necessities of life. The houses in which they live are often characterized by poor, inferior or substandard building materials which lead to disasters such as deaths and loss of properties of many residents during earthquakes and major floods. In Bam, Iran about 32,000 people lost their lives in an earthquake in 2003 due to poor structural quality housing made from substandard materials such as cardboard, corrugated tin, mud, and inadequate foundation (Unger *et al.*, 2007). Similarly, most of the poor urban residents live close to industries which compound their health risk levels as they are exposed to harmful chemicals, temperature and noise which cause injuries, poison and deaths among many of the residents (Mercado and Kjellstorm, 2008).

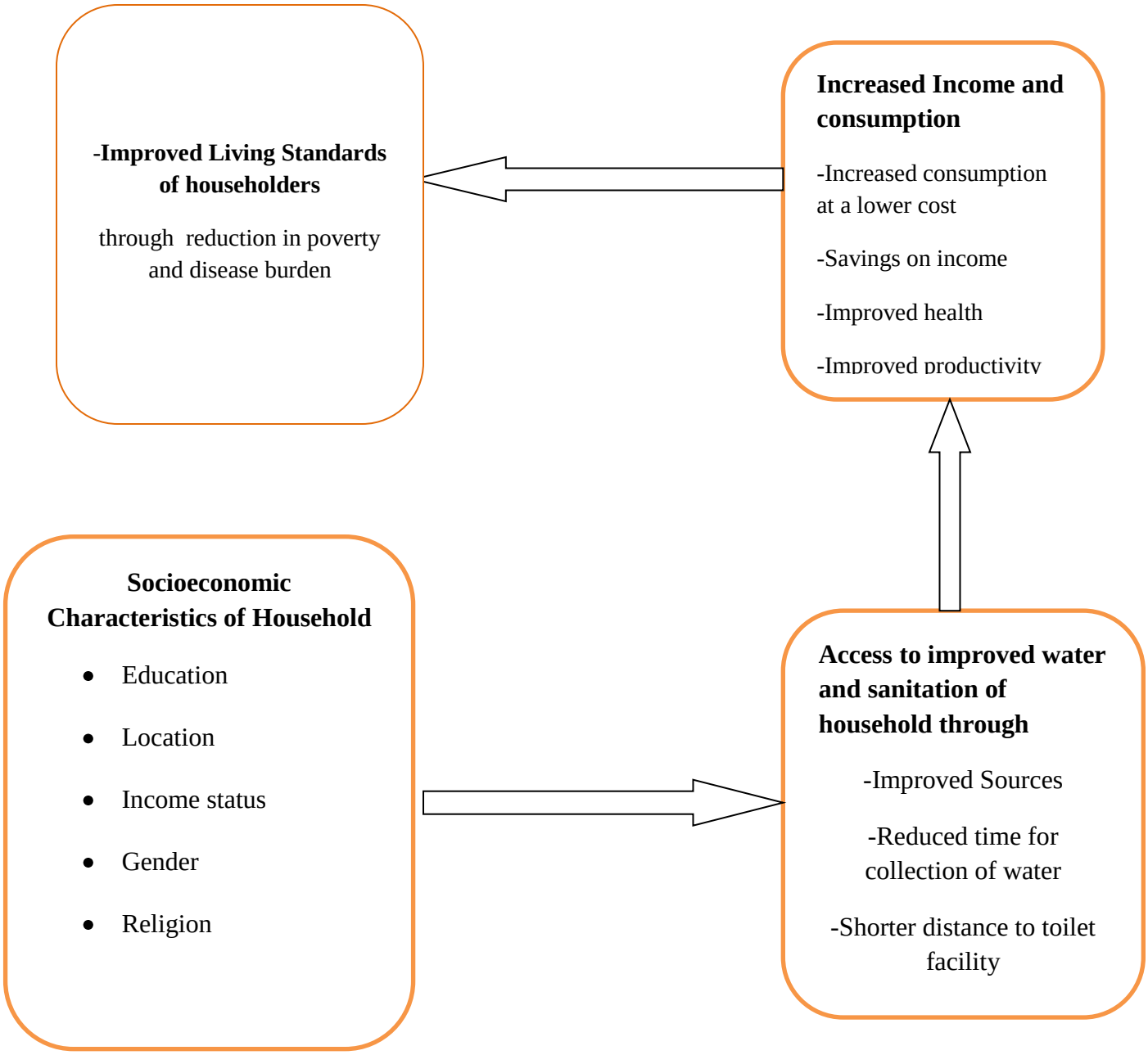
Hiles and Brown (2010) report that the income levels of the urban poor are insufficient to the extent that they are barely able to meet their basic needs let alone supply the relatively large sums of money required to meet the capital and running costs of major water supply and sanitation schemes. Hence they continue to live in poor quality environments which ultimately affect their health status. According to Mercado and Kjellstorm (2008), improved health status is identified as important in the reduction and avoidance of poverty in slums of Dhakar, Bangladesh. This is because, ill health results in reduced income and increased expenditure among many households to the extent that majority have to rely on taking loans, begging and selling their assets to pay for the treatment of ill health.

According to Esrey (1996), as cited in Whitford and others (2010), access to safe water and sanitation is crucial in breaking down the barriers and contributing to moving people out of poverty. This is in the sense that access to safe water and sanitation does not only reduce disease burden, but also increase the productivity levels of individuals which consequently reduces poverty through increased incomes and improved health status. He concludes that the two most important linkages between the environment, development, and human health are access to clean drinking water, and the ability of communities to manage wastes through improved sanitation. Datt and Ravillion (1998), Deninger and Okidi (2003) as cited in Garmendia and others (2004), in their studies in India and Uganda respectively conclude that improvements in infrastructure such as water and sanitation, transportation and telecommunication have great impacts on poverty reduction.

2.6 Conceptual Framework of the Study

The suggested conceptual framework in this study is related to the information gathered from the literature reviewed. Some independent variables (socio-economic) characteristics influence access to improved water and sanitation facilities and this link consequently affects living standards of householders. Socio-economic characteristics such as educational status, location, gender, income, and religious affiliation influence householders' access to improved water and sanitation facilities through use of improved sources of water and sanitation, reduction in time for collecting water and shorter distances to toilet facility. The access to improved water and sanitation facilities leads to increase consumption at lower cost and improves health. This consequently brings about improved living standards through reduction in poverty and disease burden. However, the study considers only how the socio-economic characteristics influence access to water and sanitation as shown by the bottom part of the conceptual framework. The analysis of factors that influence householders' access to improved water and sanitation facilities requires the use of qualitative response regression models. These models are discussed in the next section with emphasis on their theoretical underpinnings.

Figure 2.1: Conceptual Framework of the Study Illustrated by Diagram



Source: Developed by Author in February 2013.

2.7 Brief Description of Qualitative Response Models

Qualitative response models otherwise known as probability models deal with situations where the dependent variable is qualitative in nature such as whether a householder has access to improved water and sanitation services (yes) or not (no). The response variable is a binary variable or dichotomous variable that takes two values either 1 to represent yes or 0 as no. Given that Y is the dependent variable and X is the vector of independent variables influencing Y, the dichotomous variable, then Pi is the probability of Y occurring given a level of X. That is, this model explains how Y depends on X. There are three main simple approaches for developing a probability-based model for a binary variable. These are (1) Linear Probability Model (2) Probit Model and (3) Binary Logit Model (Gujarati, 2003). These three models are discussed below borrowing from the work of Gujarati (2003).

2.7.1 Linear Probability Model (LPM)

The LPM allows for a conditional probability of whether an event will occur or will not occur. Using access to improved water and sanitation facilities as the example, it is either the household has access to improved water and sanitation facilities or not. The probability that the household has access to improved water and sanitation facilities is denoted by P_i and the probability that the household does not have access to improved water and sanitation facilities is then denoted by 1-P_i.

The LPM is the simplest model. However, it has some weaknesses when it comes to using it for estimation. One of the major weaknesses is that it assumes that the probability of an event occuring increases linearly with the level of the regressor. For instance, it assumes that $P_i = E$ (Y = 1/X) increases linearly with X and so the marginal or incremental effect of X is constant throughout. Another weakness of the LPM is its non-fulfillment of the law of probability that $0 \leq E (Y_i / X) \leq 1$. Even though it is assumed that the LPM takes values that lie between 0 and 1, there is no guarantee that the estimated conditional probabilities lies exactly between 0 and 1. Furthermore, it's computed R^2 as a measure of goodness of fit is normally lower.

2.7.2 Probit Model

Estimation of binary models carried out with the use of Cumulative Distribution Function (CDF) is known as the probit model. In order to arrive at the probit model, an unobservable index is used and this unobservable index is determined by one or more of the explanatory variables. The higher the unobservable index, the higher the chances of obtaining success defined as the dependent variable and denoted as 1. For instance, assuming that this unobservable index is represented by an index I, then we can derive the probit model by assuming that access to improved water and sanitation or not depends on the index I, which is determined by one or more explanatory variables. For example, using income of the household as the explanatory variable, it is denoted in the equation below as Xi. This is expressed as;

$I_i = B_1 + B_2X_i$

To determine how the unobservable index is related to households' access to improved water and sanitation, let Y=1 if the household has access to improved water and sanitation and Y=0 if the household has no access to improved water and sanitation. Assuming there is a threshold level of the index denoted by I_i^*, it means that if I_i is greater than I_i^*, then the household has access to improved water and sanitation and the vice versa is true such that if the threshold level (I_i^*) is greater than I_i, then the household has no access to improved water and sanitation facilities.

2.7.3 Binary Logit Model

The dependent variable is the log of the odds ratio, which is a linear function of the regressors. The model allows for estimation of parameters if the data are available in grouped form, individual or micro level provided one can explicitly take into account the possible heteroscedastic nature of the error term (Gujarati, 2003).

This model satisfies the two main conditions for estimating probability models. Using the above equation, as X increases, $P_i = E(Y = 1/X)$ also increases but it is not outside the probability range of 0-1 interval. The relationship between P_i and X_i is non-linear. The conditional probability P_i approaches zero and one at a slower rate in the logit model as compared to the linear probability model.

Some of the advantages of the logit model are: (1) it allows for the transformation of a dichotomous dependent variable to a continuous variable hence it gives an exact statistical estimates of results. (2) The method is simple and the results are easily interpreted. However, some of its demerits include the fact that the estimated R^2 is of limited use in judging the goodness of fit and the use of the model can result in problems of multicollinearity if the explanatory variables are closely related (Gujarati, 2003).

For this study, the binary logit model is employed to analyze the factors that influence access to improved water and sanitation facilities. This is discussed in further detail in the next chapter, Chapter 3.

2.8 Summary of Issues from Literature

From the literature, it was found out that in order to achieve an improved sanitary condition, availability of safe and reliable water is required. Also, even though WHO includes water from boreholes and wells as improved sources of water, other writers such as McGarvey and others (2010) and Adank and others (2011) consider these sources as unimproved because they are easily susceptible to pollutants which contaminate them.

One of the determinants of access to improved water and sanitation facilities is income. Those with lower incomes do not only have limited connectivity but also tend to suffer most especially during shortages since they are unable to afford expensive alternatives such as buying from vendors. Also, the location of an individual influences his or her access to improved water and

sanitation in the sense that it is very difficult to expand piped connections to haphazard areas such as slums.

Furthermore, distance serves as another determinant of access to water and sanitation. This is because less amount of water is consumed when distance to the water source is farther (more than one kilometer). Aside distance, the amount of time spent in queuing for water is also a major factor in influencing peoples' access to water as some people may compromise on good drinking water if they have to spend beyond 30 minutes to get water.

There is a direct relationship between improved water and sanitation and health outcomes as the burden of diseases is attributable mainly to poor environmental conditions. This further affects other sectors especially the food and hospitability sub-sector as well as the tourism industry. This consequently affects the economy as a whole. Therefore, in order to move people out of poverty, then access to water and sanitation must be improved upon.

CHAPTER 3

PROFILE OF THE STUDY AREA AND METHODOLOGY

3.1 Introduction

This chapter broadly looks at the profile of the study area and the methodology employed. The survey which formed the basis of this study was carried in five (5) localities in the Greater Accra region namely: Nima, Accra New Town, La, James Town and Bubuashie. Nima and Accra New Town are predominantly migrant communities settled by several ethnic groups with those from Northern Ghana constituting the majority. The residents of James Town and La are mainly Ga indigenes while Bubuashie has a population of mixed ethnic character even though Akans constitute the majority in the area. Apart from La, all the other localities are under the jurisdiction of Accra Metropolitan Assembly (AMA). It is also worth mentioning that, all the information provided on the profile of the study area is from AMA.

3.2 PROFILE OF THE STUDY AREA

3.2.1. History and Location

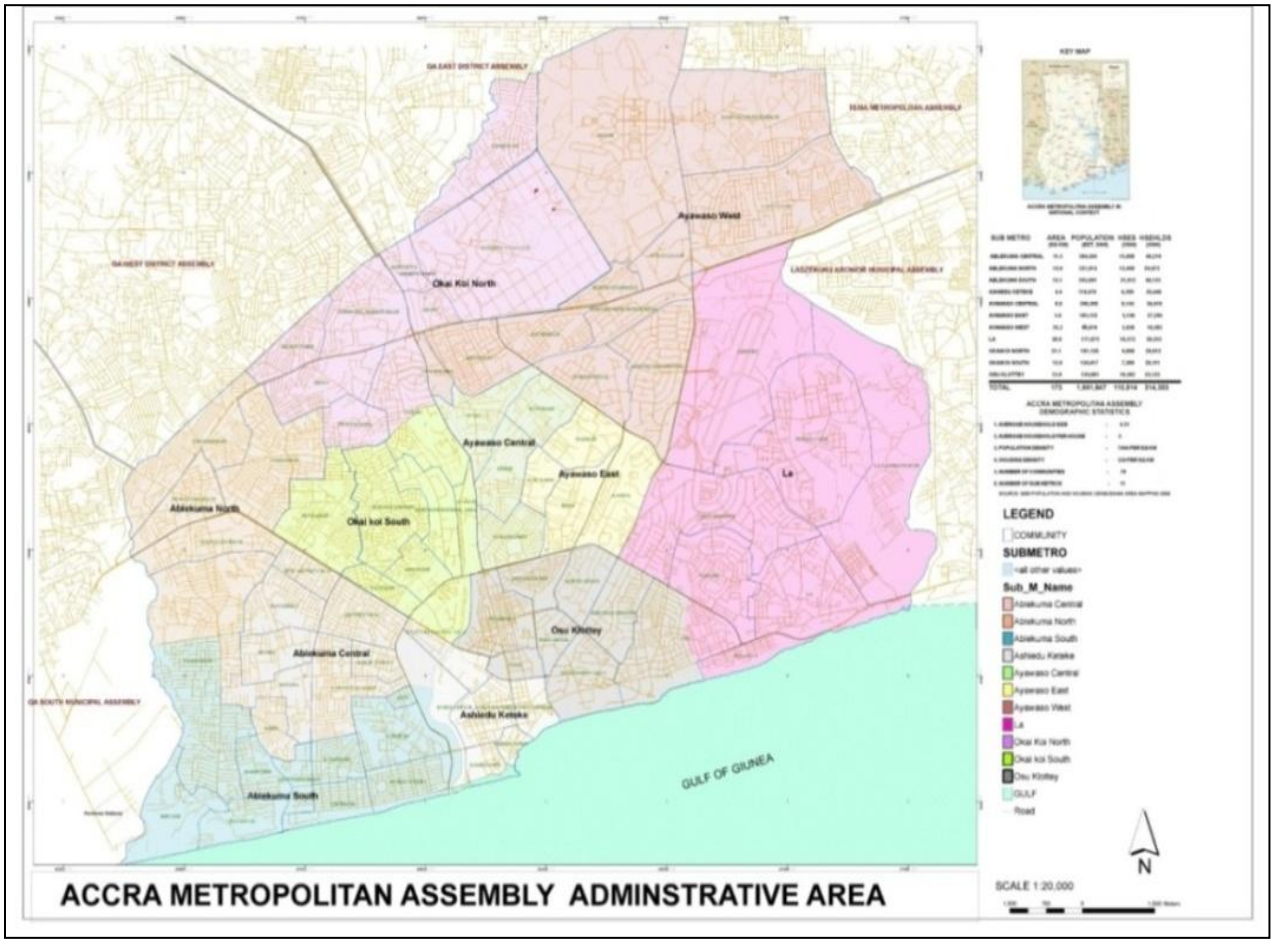
The Accra Metropolitan Assembly (AMA) is one of the ten (10) MMDAs in the Greater Accra Region established by the Local Government Act, 1993, (Act 462) and Legislative Instrument 1615. Following the creation of the Ledzokuku-Krowor Municipal Assembly (LEKMA) in 2008, AMA now operates under a new L.I. 1926 which has also reduced the Thirteen (13) Sub-Metros to Eleven (11). AMA covers an area of 173 sq km and located on Longitude 05°35'N and on

Latitude 00°06'W. It is bounded by Ga West Municipal Assembly (GWMA) to the North, Ga South Municipal Assembly (GSMA) to the West, the Southern boundary stretches along the Gulf of Guinea from Gbegbeyese to the Kpeshie Lagoon at the La Sub-Metropolitan District Council while the Eastern corridor of the Assembly is the LEKMA which was carved out of the Accra Metropolitan Assembly in 2008.

The Accra area was originally settled by indigenous Guans mainly Awutus and Larteh/Okere People. With the arrival of the Ga people as migrants from Nigeria, some 300 to 400 years ago, the Guans were gradually pushed into the Akuapem mountain area to the east and to the Awutu-Senya areas to the west through wars and migratory movements.

The map of the study area is provided as in figure 3.1 in the next page.

Figure 3.1. Map of Accra Metropolitan Assembly



Source: Accra Metropolitan Medium Term Development Plan

3.2.2 Geology and Climate

The geology of the Accra area is made up of Precambrian Dahomeyan Schists, Granodiorites, Granites Gneiss and Amphibolites to Precambrian Togo Series comprising mainly Quartzite, Phillites, Phylitones and Quartz Breccias. Other formations found are the Palaeozoic Accraian Sediments-Sandstone, Shales and Interbedded Sandstone-Shale with Gypsum Lenses. The existing lagoon systems are relatively small and flushing and have been degraded by siltation or the construction of embankments, which have restricted tidal flow. The largest of the lagoons are Sakumo (Densu delta), and Korle lagoon (Central Accra).

There is little variation in temperature throughout the year. The mean monthly temperature ranges from 24.7°C in August (the coolest) to 28°C in March (the hottest) with annual average temperature of 26.8°C.

3.2.3 Vegetation and Drainage

There are three broad vegetation zones in Accra Metropolitan area, which comprise shrub land, grassland and coastal lands. The shrubs and clusters of small trees grow to an average height of five metres (5m). The grasses are mixture of species found in the undergrowth of forests. The coastal zone comprises of two vegetation types, wetland and dunes. The coastal wetland zone is highly productive and an important habitat for marine and terrestrial life. Achimota Forest is the only forest reserve in the AMA but has been fast depleting due to residential encroachment, bush fire, sand collection and illegal tree felling. In 2013, the Government of Ghana announced plans to redevelop it as an ecotourism site.

The inadequate drainage and poorly designed channels in many parts of the Metropolis have given rise to serious flood problems. These problems are compounded by choked drainage systems.

3.2.4 Demography

The 2010 population of Accra is estimated to be about four million with additional daily influx population of 1 million who commute to the City for various socio-economic activities including social vices and economic crimes. Rural-urban migration accounts for over 35% of the population increase of Accra. While the relatively high population serves as a huge and vibrant market for investors, it also poses problem of sanitation and waste management as well as traffic congestion especially during the peak hours of the day. Accra's population like that of other urban centers is youthful with 56% of the population under the age of 24 years. It will be realized from the age-sex ratio that 51% of the population are females and 49% males.

3.2.5 Education and Health

The educational facilities are both unevenly and unequitably distributed across the Sub-Metros of the Assembly. There are about 120 Kindergarten Schools, 359 Primary Schools and 428 Junior High schools within the Accra Metropolis. Together these schools hold nearly 170,000 pupils of which about 10,000 are kindergarten pupils. As at 2009, there existed only two Vocational and Technical schools in the Metropolis. Even though extra-curriculum activities are part of the integral training of students, not all the schools practically undertake them. Some of these extra

curricula activities include; Sports, Theatre Arts, Science Laboratories, Information Communication Technology, Physical Education, and Practical Gardening, which, under normal circumstances, constitute an integral part of their training.

With regards to health facilities, there are three Government Hospitals, six Polyclinics, and 10 smaller facilities under the Ghana Health Service (GHS) institutions that provide clinical service in the Accra Metropolitan area. Four Quasi-Governmental and a host of private health care providers also offer clinical services. The major health problems of Accra are essentially communicable diseases due to poor environmental sanitation, ignorance, and poverty. Malaria has been the number one disease, accounting for about 95 per cent of all the Out-Patient Department (OPD) cases whiles diarrhoea is the second highest disease in the Metropolis. Cholera has been identified as an endemic disease with seasonal outbreaks that coincide with the onset of the rainy season.

3.2.6 Water and Sanitation

Accra is currently being supplied by two (2) major water sources, namely Weija Waterworks and Kpong Waterworks. These two water systems are not able to meet the daily water requirements of the population hence a shortfall of supply of over 130,000m^3 daily. There has also been an observation that water from the Kpong Waterworks taste better than the one from Weija. This may be due to the fact that the level of pollution of the Weija waterworks is higher.

The city currently has a dilapidated sewerage system that covers only 15% of the City's needs. This has given rise to serious environmental pollution and degradation. The projects put in place

so far by the Assembly have increased coverage by only 5% of the population. With regards to solid wastes, the City generates about Two Thousand (2,000) tonnes of garbage daily out of which the Assembly is able to collect One Thousand Five Hundred (1,500) tonnes daily based on the existing equipment. The uncollected garbage result in garbage heaps, littered pavements and choked gutters. Also, there exist inadequate drains within the metropolis.

3.2.7 Economic Activities

Accra, as the capital town of Ghana, has contributed to the economic development of the nation. It hosts a number of manufacturing industries, oil companies, financial institutions, telecommunication, tourism, education, health institutions and other important establishments.

The main occupational activities of the people of James Town for instance are fishing and petty trading while those in Nima mainly engage in trading and services which include hair dressing and communication centers. This notwithstanding, there exists a number of challenges which include the relatively high unemployment level of about 10.6% (AMA, 2010).

3.3 Sources of Data and Sample Size Determination

3.3.1 Sources of Data

The data for this study were obtained from the Fourth Round Accra Multiple Indicator Cluster Survey (FRAMICS) conducted in 2010/2011 by Institute of Statistical, Social and Economic Research (ISSER), University of Ghana, Legon, Accra. Also, secondary data were obtained from

Accra Metropolitan Assembly as it is responsible for the administration of the localities (James Town, Nima, Accra Newtown and Bubuashie).

Four (4) sets of questionnaires were used to solicit data. These were (1) household questionnaire, (2) women questionnaire, (3) men questionnaire and (4) under five questionnaire. Apart from information on the social and demographic characteristics, other questions asked were on access to sanitation and water facilities, health status of children, attitudes and sexual behavior of men and the women. The questionnaires used for this study are reported in Appendix 1.

3.3.2 Sample Size Determination

The sample size was 1,500 households selected based on 100 enumeration areas with 15 households selected from each enumeration area. The selection of the enumeration areas from each locality was based on the 2010 Population and Housing Census framework proportional to the size of the population. With a household listing of each enumeration areas, the 15 households were then selected using the systematic sampling approach. Out of the 1,500 households selected, 1,409 were successfully interviewed constituting men and women between 15-49 years and children under 5 years. Table 3.1 shows the allocation of households based on the random sampling approach used to carry out the survey.

Table 3.1 Summary of Sample Size Determination

Locality	No. of E.As	Population	Adjusted Allocation of E.As	Allocated Households
Accra Newtown	69	57,803	21	315
Bubuashie	45	43,822	16	240
James Town	20	14,579	5	75
La	106	89,194	32	480
Nima	81	72,950	26	390
Total	321	278,348	100	1500

3.4 Categorization of Variables

Two major variable groups were explored in this study. These were the dependent and the independent variables. Each independent variable group was explored at different analytical level of the analysis to determine its association with the dependent variable.

3.4.1 Dependent Variable

Three main dependent variables, directly related to water and sanitation, were used in the study. These were (1) access to water for drinking (2) access to water for other domestic purposes and (3) access to toilet facilities. Each of these three dependent variables was reclassified into different categories using dummy variables in order to analyze the data using binary logistic

regression analysis. As such, 1 was used to represent households' with access to either improved water for drinking, improved water for other purposes or access to improved toilet facilities and 0 for unimproved sources of these facilities.

The following sections provide information on the definitions of the various dependent variables used in the study.

3.4.1.1Access to Water

- **Improved water for drinking used in this study**

The sources of water considered as improved according to this study are water piped into dwelling and bottled water. However, based on the definition of World Health Organization (WHO) (2008) the sources of water considered as improved include water piped into dwelling, water piped into compound/yard/plot, water piped into neighbor, protected wells, protected spring, boreholes and public standpipe. This study limits improved water sources to piped water into dwelling and bottled water. Water produced at the source of the plant of Ghana Water Company is generally considered to be excellent in line with international standards. However, extensive leakages and damages to the pipelines linking homes lead to contamination of the end source water. Thus in Accra purifiers are purchased by affluent households and hotels to further process piped water before drinking.

- **Unimproved water for drinking used in this study**

Based on the study, unimproved water sources for drinking are water from sources such as piped into compound/yard/plot, piped into neighbor, sachet water, river /stream, dam/lake/pond/canal, tanker truck, spring, rainwater, cart with small tank/drum, public tap and borehole. Unimproved

water for drinking according to WHO are sachet water, tanker truck, cart with small tank/drum, bottled water, rainwater, unprotected well and unprotected spring.

- **Improved water for other domestic purposes used in this study**

According to the study, the sources of water considered as improved for other domestic purposes are water from piped into dwelling, piped into compound/yard/plot and piped into neighbor and rainwater. The sources of improved water for other domestic purposes as defined by WHO (2008) are water from piped into dwelling, piped into compound/yard/plot and piped into neighbor public tap or standpipe, boreholes, protected well, protected spring and rainwater.

Unimproved water for other purposes as defined by the study include sachet water, river /stream, dam/lake/pond/canal, tanker truck, spring, cart with small tank/drum, public tap, borehole while unimproved water for other purposes includes river/stream, dam/lake/pond/canal, tanker truck, spring, cart with small tank/drum.

3.4.1.2 Access to Sanitation

- **Improved Toilet Facilities**

For this study, improved toilet facilities are flush piped to sewer system and flush to septic tank. However, based on the WHO (2008) definition, improved toilet facilities are flush piped to sewer system, flush to septic tank and flush to pit latrine, ventilated improved pit latrine (V.I.P) with a slab and compositing toilet. The differences in the definitions of improved toilet facilities used in this study and that of WHO is the exclusion of flush to pit latrine, ventilated pit latrine with a slab and compositing toilet facilities in the study. The study considers flush piped to sewer

system and flush to septic tank only as improved sources of toilet facilities because, ideally, these two sources involve the safest and most hygienic methods. For instance, the water flushed into pit latrines can lead to the collapse of the building housing the latrine.

- **Unimproved Toilet Facilities**

Based on the study, unimproved toilet facilities are flush to somewhere else, flush to pit latrine, flush to an unknown place, pit latrine, compositing toilet, bucket, hanging toilet/hanging latrine and no facility/bush/field/beach. Unimproved toilet facilities based on WHO (2008) definition are flush to somewhere else, flush to an unknown place, bucket, hanging toilet/hanging latrine, pit latrine without a slab and no facility/bush/field/beach.

3.4.2 Independent Variables

As discussed in Chapter 2, studies have shown that some socio-economic characteristics such as income, locality, education and gender influence one's access to water and sanitation facilities (Bosch *et al.*2001; Smith and Hanson, 2003). For this study, some of the socio-economic variables explored to explain their influence and associations with the dependent variables are: gender, education, locality status, wealth status and religion.

The gender of respondents was grouped into male and female. Educational attainment was categorized as those with no formal education, those with primary, middle/JHS and secondary/SHS and higher education. With locality status, respondents were put into three main groupings and these were; indigenous, mixed and migrants. Similarly, religion of respondents was reclassified as Christians, Islamic and adherents of traditional religions while their income

or wealth status were based on whether they were the poorest, second poorest, middle poorest, fourth poorest or the richest.

3.5 Data Analysis

Data were analyzed in three phases using the Statistical Package of Social Sciences (SPSS) Version 18 based on SPSS syntax commands. Phase one of the analysis involved descriptive univariate analysis where frequencies and percentages were derived to describe the social and demographic characteristics such as the sex, age, wealth status and educational levels of the household heads. The phase two analysis employed a bivariate analysis using the chi-square test. This was to establish whether there was statistically significant association between access to improved or unimproved water and sanitation and selected socio-economic variables of living standards based on grouped data. In the third phase, binary logistic regression analysis was used to determine the factors that influenced households' access to improved water and sanitation.

3.5.1 Description of the Binary Logistic Regression Analysis Used for the Study

As discussed in Chapter 2, Bosch and others (2001) and Smith and Hanson (2003) suggest that several factors determine a household's access to improved water and sanitation facilities. In order to analyze the determinants of access to improved water and sanitation facilities, a logistic regression model was employed. A householder's access to improved water and sanitation facilities is assumed to depend on his or her socioeconomic characteristics. These socio-economic characteristics include education, gender, location, income status, and religion.

It is argued that the probability of a householder having access to improved water and sanitation services is related to his/her socio-economic characteristics. This probability P_i is a "hidden" or latent variable which is not directly observed. However what is observed is that the householder either has access to or no access to improved water and sanitation facilities. This observation is represented by a dummy variable (Y_i) which has a value of 1 if the householder has access to improved water and sanitation facilities and zero (0) if the householder does not have access to improved water and sanitation. The relationship is indicated below in Equation 3.1.

$$\mathbf{P_i = B_0 + B_1 X_1 \ldots + B_n X_n + U_i} \qquad \textbf{EQUATION 3.1}$$

where

$\mathbf{B_o}$ is constant

$\mathbf{B_1 \ldots B_n}$ are the coefficient of the parametres of the socioeconomic characteristics;

$\mathbf{X_1 \ldots X_n}$ are the socio-economic characteristics of the householder and

$\mathbf{U_i}$ is the error term.

In order to estimate the probability of the event, a logistic regression procedure is used to model the log odds as a linear function of the explanatory variable. The logistic regression equation for the estimation is given as in Equation 3.2.

$$\{\log(P_i/(1-P_i)\} = B_0 + B_1 X_1 \ldots B_n X_n + U_i \quad \text{EQUATION 3.2}$$

where

p_i is the probability that a household head has access to improved water and sanitation facilities,

1-p is the probability that a household head does not have access to improved water and sanitation facilities.

From Equation 3.2, the left hand side is the log odds ratio and is a linear function of the explanatory variables. The log odds ratio describes the odds favouring the dependent variable (access to improved water and sanitation facilities). The right hand side of this equation contains the socio-economic characteristics such as educational attainment, wealth status, religious preferences, locality status and other variables that are hypothesised to influence access to improved water and sanitation.

Inserting the variables, the equation for the study is given as shown in Equation 3.3.

$$\text{Log } (p/1-p) = ß_o + ß_1 \text{ Wealth} + ß_2 \text{ Education} + ß_3 \text{ Moslem} + ß_4 \text{ Gender} + ß_5 \text{ Locality1} + ß_6 \text{ Locality2} + U_i \quad \text{EQUATION 3.3}$$

where

Wealth is the income status of the respondents.

Education is denoted as the level of educational qualification attained by the household head ranging from never been to school, primary level, middle/JSS level to secondary and above.

Moslem is used to denote the religious affiliation of the respondents with reclassification done such that a follower of Islam (Muslim) is classified as one (1) and Non-Muslims as zero (0).

Gender is denoted by the sex of the respondents.

Locality1 refers to respondents living in James Town and La. These people are largely Ga indigenes. The value 1 is used for these Ga indigenes and zero is used for all other people.

Locality2 refers to respondents living in Bubuashie. These people come from mixed backgrounds and include both migrant and indigenes. The value 1 is used for people living in Bubuashie while zero is used for all other people in the sample.

$\mathbf{U_i}$ is the error term assumed to have a zero mean and constant variance.

Appendix 2 provides the computer programme written by the author using SPSS syntax commands. This programme was used to analyse the survey data based on simple statistical analysis, chi-square and binary logistic regression analyses.

CHAPTER 4

RESULTS

4.1 Introduction

This chapter discusses the results of the analysis of the survey data with regards to issues on access to water and sanitation in the five (5) selected localities in Accra as well as the determinants of the access to improved water and sanitation facilities.

4.2 Background Information of Respondents

Based on the frequency analysis, the majority of the respondents were males constituting about 65.7% of the sample. Females constituted the other 34.3% (Table 4.1). With regards to religion, about 71.5% of the respondents were Christians; Muslims constituted 22.40% and adherents of Traditional African Religions made up 6.2% of the respondents. The findings with regards to religious affiliation are generally similar to those obtained for the 2010 National Report of the Population and Housing Census (GSS, 2012).

With regards to their ethnicity, Ga/Ga Dangmes formed the largest group with about 34.2% share of the respondents. Non-Ghanaians constituted the smallest ethnic group accounting for about 3.2% of the total respondents. Akans, Ewes, Mole-Dagbani people accounted for about 27.7%, 15.6%, and 10.6% respectively. The dominance of Ga/Ga Dangmes in the sample is due to the relatively large concentration of indigenes in the sample.

With regards to educational level attainment, the highest educational level attained by majority of the respondents was the Middle or Junior High School constituting about 38.1% of the respondents, followed by those who completed Secondary School and above representing about 36.6% while those who completed primary level accounted for 10.1%. As much as 15.1% of the total respondents have received no formal education. Therefore about five (5) out of six of the respondents (85%) are literate in terms of receiving some formal education.

Out of a total of five (5) poor urban localities considered for the study, majority of the respondents (32%) were based in La, an indigenous town; 26% of the respondents lived in Nima primarily a migrant area. Accra Newtown (predominantly migrant) and Bubuashie (mixed) were home to 21% and 16% respectively. James Town, a largely indigenous community, had about 5% of the respondents as shown in Table 4.1. Overall, 37% of the respondents were from James Town and La considered to be mainly settled by Ga indigenes. About 47% of the respondents were from Nima and Accra Newtown which are largely inhabited by migrants. The remaining 16% were from Bubuashie, a mixed area of migrants and indigenes.

Occupancy status as shown in Table 4.2 indicates that majority of the respondents (54%) lived in rented apartments while 31.9% lived in family houses free of charge. About 11.1% of the respondents owned their own places of residence. Squatting was a source of residency for about 0.6% of the respondents. With regards to type of building material used for roofing their houses, about 97.8%, 0.4%, 0.3% and 1.1% used metal sheet/slate/asbestos, wood planks, polished wood and cement respectively. The dominant roofing material used was metal sheet/slate/asbestos reflecting the general pattern of roofing of houses in urban Ghana as revealed by the 2010 Population and Housing Census report.

About 81.4% of the respondents owned radio sets while 94.8% used mobile phones. Charcoal was the leading source of fuel for majority of the sample (53.2%); liquefied petroleum Gas (LPG) was the second most important source constituting about 35.9%. The least important source of fuel was firewood used by 0.5% of the population. In terms of wealth status, the poorest people constituted the largest group accounting for about 22.4% of the respondents. The richest comprised of about 18.4% of the respondents.

Table 4.1: Summary of Socio-Economic Characteristics of Survey Respondents Based on Frequency Analysis.

Item	Percentage Frequency
Gender	
Female	34.3%
Male	65.7%
Religion	
Christian	71.5%
Islam	22.4%
Traditional	6.2%
Ethnicity	
Akan	27.7%
Ga/Ga Dangme	34.2%
Ewe	15.6%
Mole-Dagbani	10.6%
Non-Ghanaians	3.2%
Others	8.7%
Educational Attainment	
None	15.1%
Completed Primary School	10.1%
Completed Middle/JHS	38.1%
Completed Secondary School and above	36.6%
Locality	
Bubuashie	16.0%
La	32.0%
James Town	5.0%
Nima	26.0%
Accra New Town	21.0%

Table 4.2: Summary of Frequency Analysis of Socio-Economic Characteristics

Item	Percentage Frequency
Roofing Material of Dwelling	
➢ Wood planks	0.4
➢ Cardboard / Polythene sheets	0.1
➢ Mud / Mud bricks / Earth	0.1
➢ Metal sheet or slate / asbestos	97.8
➢ Parquet / Polished wood	0.3
➢ Calamine/Cement fibre	0.1
➢ Ceramic tiles	0.1
➢ Cement	1.0
➢ Roofing shingles	0.1
Source of Information	
Radio:	
➢ Yes	81.4
➢ No	18.5
➢ Others	0.1
Mobile Phone Ownership:	
Yes	94.8
No	5.1
Occupancy Status	
➢ Own	11.1
➢ Rent	54.0
➢ Squatting	0.6
➢ Caretaker	1.1
➢ Family House (without rent)	31.9
➢ Other (specify)	1.2
Source of Fuel (cooking):	
➢ Electricity	1.2
➢ LPG (Gas)	35.9
➢ Kerosene	1.5
➢ Charcoal	53.2
➢ Wood/firewood	0.5
➢ No cooking	7.7
Wealth	
➢ Poorest	22.4
➢ Second	19.7
➢ Middle	20.2
➢ Fourth	19.3
➢ Richest	18.4

4.3 Sources of Water for Drinking

The sources of water for drinking are reported in Table 4.3. The main source of water for drinking was the sachet water used by about 59% of the sample. Overall, about 39.3% of the respondents used pipe borne water for drinking delivered through various modes. Bottled water, a status symbol of the middle and upper classes, was the main source of water for only 1.1% of the respondents.

For this study, bottled water and water piped into dwelling are considered improved sources of water for drinking. Hence based on the definition used in this study, the proportion of the respondents using improved water for drinking was 4.4%. The remaining 95.6% of the respondents used unimproved water for drinking given the persistent contamination of piped water flowing into public places and non-exclusive places.

Using the WHO definition, improved sources of water for drinking are water piped into dwelling, piped into compound/yard/plot, piped into neighbor, protected wells, protected spring, boreholes, public standpipe and rainwater. Hence based on WHO definition, improved water sources used in this study such as piped into dwelling, piped into compound/yard/plot, piped into neighbor, protected wells, protected spring, boreholes, and public standpipe, the proportion of respondents with access to improved drinking water was 39.6%. The remaining 60.4% of the respondents used unimproved water for drinking and these included water from unprotected spring, bottled water, sachet water, rivers, dams, tanker-truck and cart with small tank.

Table 4.3: Source of Water for Drinking

Source	Improved/Unimproved*	Frequency	Percentage
Piped into dwelling	Improved	46	3.3
Piped into Compound/Yard/Plot	Unimproved	230	16.3
Piped into Neighbor's Place	Unimproved	226	16.0
Public Tap/Standpipe	Unimproved	52	3.7
Tube well/borehole	Unimproved	2	0.1
Protected well	Unimproved	2	0.1
Tanker- Truck	Unimproved	3	0.2
Bottled	Improved	16	1.1
Sachet Water	Unimproved	832	59.0
Total		1409	100.0

*** Based on this study**

4.4 Sources of Water for Other Domestic Purposes

For this study, the sources of water for other domestic purposes are piped water into dwelling, piped into a neighbor's place, piped water into compound/yard/plot and rainwater. Hence based on the definition used in this study, the proportion of the respondents using improved water for other domestic purposes was 88.7%.

Again, the two most important sources of water used by respondents were from piped water into neighbor (40.7%) and piped water into compound/yard/plot (39%). The least number of respondents (0.1%) resorted to tube well/borehole while those who use protected well and cart with small tank are both home to 0.4%. The remaining respondents (9.0%, 9.1% and 1.4%)

relied on piped water into dwelling, public tap/standpipe and tanker-truck respectively (refer to Table 4.4).

Using the WHO definition, improved sources of water for other domestic purposes are water piped into dwelling, piped into compound/yard/plot, piped into neighbor, protected wells, protected spring, boreholes, public standpipe and rainwater. Hence based on WHO definition, the proportion of respondents with access to improved water for other domestic uses was 98.3%. The remaining 1.7% of the respondents used unimproved water for other domestic purposes and these included water from unprotected spring, tanker-truck and cart with small tank.

Overall, about 11.3% of the respondents used unimproved sources of water for other purposes based on the definition used in this study while about 1.7% of the respondents used unimproved sources of water for other purposes based on the definition of the WHO (2008).

Table 4.4: Source of Water for Other Purposes

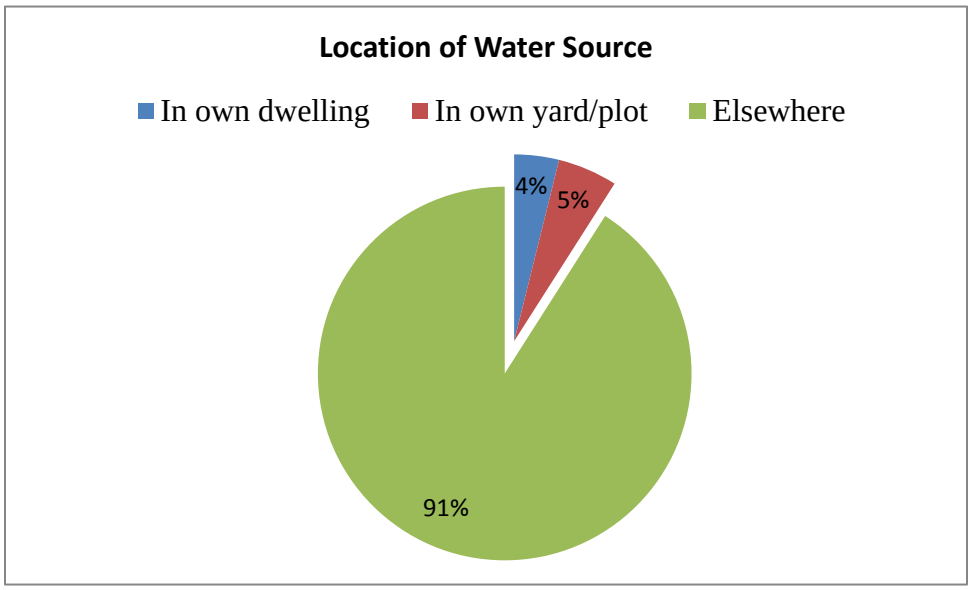
Source of Water	Improved/Unimproved*	Frequency	Percentage
Piped into Dwelling	Improved	76	9.0
Piped into Compound	Improved	331	39.1
Piped into Neighbor's	Improved	344	40.6
Public tap	Unimproved	77	9.1
Borehole	Unimproved	1	0.1
Protected Well	Unimproved	3	0.4
Tanker-truck	Unimproved	12	1.4
Cart with small tank	Unimproved	3	0.4
Total		847	100.0

*** Based on this study**

4.5 Location of Water

The location of water source is presented in Figure 4.1 as a pie chart. The vast majority of respondents made up of 91% have to travel outside their homes to fetch water while only 4% of the respondents have water source in their dwelling.

Figure 4.1: A Pie Chart Showing the Location of Water Source



4.6 Time Taken to Collect Water

Furthermore, findings from the study as presented in Table 4.5 show that out of the 91% of the respondents who travelled elsewhere to fetch water, majority of the respondents (60.2%) spent about one to five minutes to get to a water source, while 16.2% and 21.3% spent about six to 10 minutes and 11 to 30 minutes respectively to get water. Overall, the majority of the respondents (97.7%) used a maximum of 30 minutes to collect water for their household uses.

Table 4.5: Time Taken to Get to a Water Source

Time Taken to Get to a Water Source		
	Frequency	%
1-5 minutes	85	60.2
6-10 minutes	23	16.2
11-30 minutes	30	21.3
N/A	3	2.1
Total	141	100.0

4.7 Persons Collecting the Water

With regards to persons who collected water for household use, adult women aged between 15 years and above constituted the largest group of people collecting water (48.9%). The second largest group (34%) of people who collected water was made up of adult men aged between 15 years and above. Children defined as people less than 15 years of age made up of 12% of the respondents who collected water with female children accounting for the larger share of water collectors (8.5%) as compared to male children (3.5%).

Table 4.6: Persons Collecting Water in a Household

Persons collecting water		
	Frequency	Percentage
Adult woman (age 15+ years)	69	48.9
Adult man (age 15+ years)	48	34
Female child (under 15)	12	8.5
Male child (under 15)	5	3.5
Children (both sexes)	3	2.1
Adult women and children	3	2.1
Adult men and children	1	0.7
Total	141	100.0

4.8 Use of Toilet Facilities

4.8.1 Kind of Toilet Facility

For this study, only flush to piped sewer system and flush to septic tank are considered improved sources of toilet facility. Hence based on the definition used in this study, the proportion of the respondents using improved toilet facilities was 32.2% while the remaining 67.8% of the respondents used unimproved toilet facilities such as flush to latrine, flush to somewhere else, pit latrine without slab, bucket and the bush and fields.

As shown in Table 4.7, majority of the respondents (42.7%) used the ventilated improved pit latrine as their main source of toilet facility. The second most important source of toilet facility was the flush to septic tank which was used by 28% of the respondents. The use of the bucket method of toilet disposal, which has been outlawed, existed with about 9.6% of the respondents using this method while 2.7% flush their toilet but unaware of its final disposal and 1% practise open defecation.

Using the WHO definition, improved sources of toilet facilities are flush to piped sewer system, flush to septic tank, flush to pit latrine, ventilated improved pit, pit latrine with slab while the unimproved toilet facilities are flush to somewhere else, bucket and the bush, fields and beach. Hence based on their definition, the proportion of respondents with access to improved toilet facilities was 84%.

The average mean of respondents with access to improved toilet facility as defined for the purposes of the study was 33%. However, based on definition of WHO, the proportion of respondents with access to improved toilet facility was about 84%. The main reason that accounted for the difference in results with regards to improved toilet facilities is because the study's definition limits access to improved toilet facilities to only flush toilet connected to a recognized sewer system or septic tank due to the high level of hygiene and safety. However, WHO included flush to pit latrine, ventilated pit latrine and compositing toilet to their improved toilet facilities.

Table 4.7: Kind of Toilet Facility Used

Kind of Toilet Facilities	Improved /Unimproved*	Frequency	Percentage
Flush to piped sewer system	Improved	59	4.2
Flush to septic tank	Improved	394	28.0
Flush to pit (latrine)	Unimproved	23	1.6
Flush to somewhere else	Unimproved	14	1.0
Flush, do not know where	Unimproved	24	1.7
VIP	Unimproved	602	42.7
Pit Latrine with slab	Unimproved	105	7.5
Pit Latrine without slab/Open pit	Unimproved	37	2.6
Bucket	Unimproved	135	9.6
No facility/Bush/field/Beach	Unimproved	14	1.0
Others	Unimproved	2	0.1
Total		1409	100.0

*** Based on this study**

Figure 4.2 below illustrates the proportion of the respondents using shared toilet facility. About nine in ten of the respondents (89.9%) utilised shared toilet facilities. About 63.2% of the respondents shared the toilet facility with the public while 36.8% shared the facility exclusively among other household members (no outsiders) (refer to Table 4.8).

Figure 4.2: A Pie Chart showing the usage of Toilet Facility

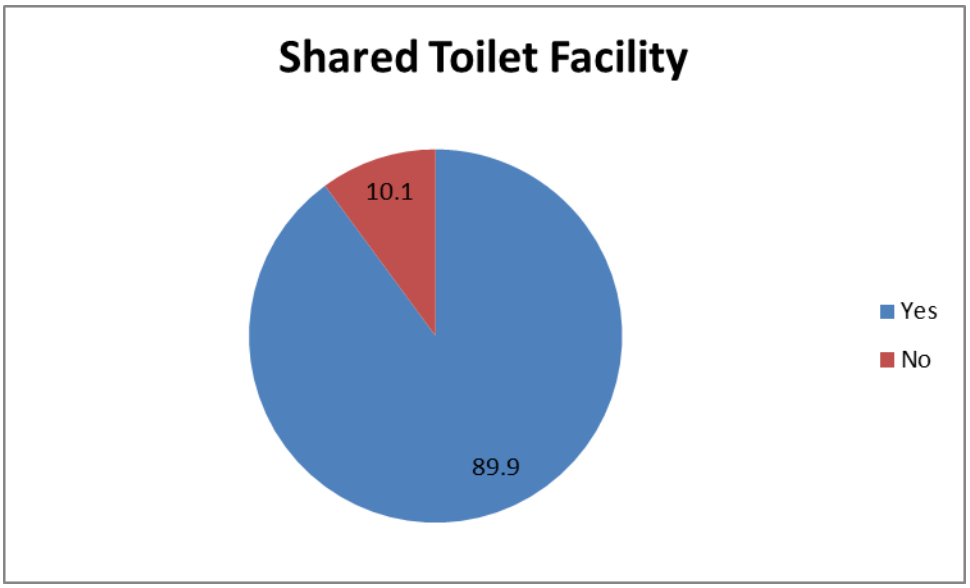


Table 4.8: Users of Toilet Facility

Users of Facility	Frequency	Percentage
Shared facility with other household members	462	36.8
Shared facility with public	792	63.2
Total	1254	100.0

4.9 Results of Chi-Square Analysis of Association between Access to Water and Sanitation and Some Socio-Economic Characteristics Based on Definition of the Study

The results of the chi-square analysis to determine the degree of association between access to improved water and sanitation and some socio-economic characteristics are reported in Table 4.9 based on the definition used in this study. From Table 4.9, the results of the chi-square analysis to determine the degree of association between access to improved water for drinking and some socio-economic characteristics revealed that socio-economic characteristics such as Education and Wealth were statistically significantly associated with householders' access to improved sources of water for drinking.

With regards to the degree of association between access to improved water for other domestic purposes and the socio-economic characteristics, the results revealed that socio-economic characteristics such as Education, Locality and Ethnicity were statistically significantly associated with householders' access to improved sources of water for other domestic purposes.

The degree of association between access to toilet facility and the socio-economic characteristics as revealed in Table 4.9 indicated that Education, Wealth, Locality, Religion and Ethnicity were statistically associated with the level of householders' access to improved toilet facility.

It is important to note that chi-square analysis is useful to provide possible candidates for use in regression analysis to determine factors influencing particular choices of respondents. However chi square analysis does not imply causation.

Table 4.9: Results of Chi-Square Analysis of Association between Access to Water and Sanitation and Some Socio-Economic Characteristics Based on Definitions Used in this Study.

Dependent Variables	Independent variables	Pearson chi square	P-value
Drinking Water	Education	9.843	0.020**
	Locality	2.778	0.249
	Gender	2.067	0.151
	Wealth	58.401	0.000**
	Ethnicity	2.414	0.789
	Religion	2.647	0.266
Water for Other Purposes	Education	12.346	0.006**
	Locality	20.117	0.000**
	Gender	0.534	0.465
	Wealth	5.767	0.217
	Ethnicity	14.238	0.014**
	Religion	5.314	0.070
Toilet Facility	Education	79.187	0.000**
	Locality	0.0046	0.000**
	Gender	0.342	0.559
	Wealth	0.0024	0.000**
	Ethnicity	76.547	0.000**
	Religion	62.624	0.000**

**** Significant at the 5% level used for this study.**

4.10: Results of Chi-Square Analysis of Association between Access to Water and Sanitation and Some Socio-Economic Characteristics based on WHO Definitions.

Based on the definitions of WHO, the chi-square analysis results are reported in Table 4.10. The analysis revealed that socio-economic characteristics such as Education, and Wealth were statistically significantly associated with householders' access to improved sources of water for drinking. This result is similar to that reported in Table 4.9 which was based on the specific definitions adopted for this study.

With regards to the degree of association between access to improved water for other domestic purposes such as cooking and hand washing, the results indicated that Education and Wealth were statistically significant as their p-values were less than 0.05. In contrast, Education and Locality were the statistically significant factors associated with access to improved water for other domestic purposes based on the specific definitions used in this study (refer to Table 4.9).

Analysis of the degree of association between access to toilet facility and the socio-economic characteristics as shown in Table 4.10 indicated that Locality was the only variable which was statistically associated with the level of householders' access to improved toilet facility. This was in contrast with the results revealed by the study reported in Table 4.9 where all the variables except gender were statistically significantly associated with householders' access to improved toilet facilities.

Table 4.10: Results of Chi-Square Analysis of Association between Access to Water and Sanitation and Some Socio-Economic Characteristics Based on WHO Definitions.

Dependent Variables	Independent variables	Pearson chi square	P-value
Drinking Water	Education	30.256	0.000**
	Locality	1.715	0.424
	Gender	3.243	0.720
	Wealth	0.001	0.000**
	Ethnicity	1.896	0.863
	Religion	0.459	0.795
Water for Other Purposes	Education	34.992	0.000**
	Locality	2.705	0.259
	Gender	1.676	0.195
	Wealth	0.001	0.000**
	Ethnicity	2.868	0.720
	Religion	1.791	0.408
Toilet Facility	Education	3.545	0.315
	Locality	31.712	0.000*
	Gender	0.005	0.942
	Wealth	4.304	0.366
	Ethnicity	4.522	0.477
	Religion	3.892	0.143

. **** Significant at the 5% level used for this study**

4.11 Discussion of Results of Logistic Regression Analysis of Factors Influencing Householders' Access to Improved Water for Drinking

Improved source of drinking water used for the purposes of this study denotes water piped into dwelling and bottled water. Based on this definition, about 4.4% of the respondents had access to improved drinking water and the remaining 95.6% did not have access to improved source of water and used unimproved sources such as sachet water, wells and tanker truck. Table 4.11 shows the results of the logistic regression analysis of factors influencing access to improved drinking water sources.

The results revealed that wealth was an independent variable in the regression model that was statistically significant in determining an individual's level of access to improved source of water for drinking. This means that as one's level of income increases, he or she is likely to have access to improved sources of water for drinking because he or she has a higher purchasing power. This assertion is supported by Bosch and Others (2001) who posit that the higher income groups can afford to buy more and are also able to afford private alternatives in times of shortages as compared to the urban poor. Muslim and Locality (mixed) were statistically significant at 10% significance level as the p-values were less than 0.1 but were not used for discussion of results as the significance levels were above the 5% level used in this study.

Table 4.11: Logistic Regression Analysis Results for Source of Drinking Water

Explanatory Variables	Parameter Estimate	Standard Error	Probability level of Significance
Intercept (constant)	-5.807	0.654	0.000**
Gender	0.138	0.317	0.663
Education	0.000	0.160	1.000
Wealth	0.725	0.126	0.000**
Moslem	0.657	0.353	0.063
Locality1 (Indigene)	0.077	0.321	0.881
Locality2 (Mixed)	-0.861	0.561	0.095

**** Significant at the 5% level used for this study.**

The power of the model is high as the percentage correctly classified was 95.6%.

4.12 Discussion Results of Logistic Regression Analysis of Factors Influencing Householders' Access to Improved Water for Other Domestic Uses

In this study, improved sources of water for other domestic uses were water piped into dwelling, piped into compound/yard/plot, piped into neighbour's home and rainwater. Based on this definition, about 88.7% of the respondents used improved water while the remaining 11.3% of respondents used unimproved water for other domestic purposes. Table 4.12 shows the results of the logistic regression analysis of factors influencing access to improved sources of water for other domestic uses (excluding drinking) by householders in the survey area.

The results of the analysis indicate that both education and wealth were significant at 5% level in influencing the adoption or use of improved water sources for other domestic uses by householders. This implied that as educational and wealth status of household heads' increased, there was a higher likelihood that they would adopt improved water sources to meet their domestic household chores such as cooking. Both Locality variables were also statistically significant in influencing householders' access to improved access to water for other domestic purposes. This result must be interpreted with respect to the base locality variable, migrant implying that compared to migrants, indigenes and people from mixed areas were less likely to have access to improved sources of water for other domestic purposes.

Table 4.12: Logistic Regression Results for Source of Water for Other Purposes

Explanatory Variable	Parameter Estimate	Standard Error	Probability level of significance
Intercept	1.051	0.414	0.011**
Gender	-0.379	0.253	0.134
Education	0.255	0.120	0.035**
Wealth	0.173	0.088	0.050**
Moslem	-0.267	0.292	0.360
Locality1 (Indigene)	-0.753	0.326	0.021**
Locality2 (Mixed)	-0.818	0.302	0.007**

**** Statistically significant at the 5% level used for this study.**

The power of the model is high as the proportion correctly classified was 88.5%.

4.13 Discussion Results of Logistic Regression Analysis of Factors Influencing Householders' Access to Improved Toilet Facility.

Improved source of toilet facilities used for the purposes of this study were flush to a piped sewer system and flush to septic tank. Unimproved sources were pit latrines, bucket, hanging toilet as well as the free range system (bush, field and beach). About 32.2% of the respondents had access to improved sources of toilet facilities. The remaining 67.8% of the respondents used unimproved sources of toilet facilities. Table 4.13 reports the results of the logistic regression analysis of the factors influencing access to improved toilet facilities by respondents.

The results indicated that all the explanatory variables (Gender, Education, Wealth and Locality) except Religion (Muslim) were statistically significant variables which determined a household head's access to improved toilet facility at 5% level of significance. Also, education and wealth correlated positively with access to toilet facility. This meant that as one's educational level and wealth status increased, one was more likely to have access to improved toilet facility.

The location of respondents was also significant in determining access to improved toilet facilities such that indigenes and respondents from mixed background were also more likely to have access to improved toilet facilities as compared to the migrants. Gender was also statistically significant variable in determining households' access to improved toilet facilities; the negative coefficient indicated an inverse relationship such that men were less likely to have access to improved toilet facilities as compared to females.

Table 4.13: Logistic Regression Results for Access to Improved Toilet Facilities

Explanatory Variables	Parameter Estimates	Standard Error	Probability Level of Significance
Intercept	-3.633	0.289	0.000**
Gender	-0.525	0.151	0.001**
Education	0.222	0.084	0.008**
Wealth	0.546	0.053	0.000**
Moslem	-0.230	0.217	0.289
Locality1 (indigene)	1.599	0.166	0.000**
Locality1 (mixed)	1.530	0.197	0.000**

**** Statistically significant at the 5% level used for the study.**

The overall percentage correctly classified was 74.6%.

4.14 Discussion of Results of Logistic Regression Analysis of Factors Influencing Householders' Access to Water and Sanitation based on WHO Definition

Another analysis was undertaken based on the categorization of what constitutes improved water and sanitation by World Health Organization (WHO).The logistic regression analysis undertaken with the results reported in Tables 4.11, 4.12 and 4.13 are repeated using the WHO definitions with the results shown in Table 4.14.1, 4.14.2 and 4.14.3.

4.14.1 Results of Logistic Regression Analysis of Factors Influencing Householders' Access to Improved Drinking Water

Based on the definitions of WHO, improved sources of water for drinking include water piped into dwelling, piped into compound or yard, piped into neighbour's place, public standpipe, boreholes, protected wells and rainwater. Overall, the frequency analysis showed that about 39.6% of the respondents used improved sources of water for drinking while the remaining 60.4% used unimproved sources such as sachet water, wells and tanker truck.

The results of the logistic regression analysis showed that four of the independent variables Gender, Education, Moslem and Wealth had statistically significant influence on the dependent variable, the likelihood of using improved water for drinking. The negative signs for the coefficients of Education and Wealth however are inconsistent with economic theory and are also different from the comparative results reported in Table 4.11. The inconsistency of the WHO-based results with economic theories and a priori expectations suggest on preliminary grounds the lack of validity of the WHO definitions as applicable to the study area. The lack of

validity is supported by the relatively lower power of the model with only 64.9% of correct classification (refer to Table 4.14.1) compared to the comparative power of 95.6% reported in Table 4.11 when the definition of improved water for drinking was used based on this study and applied in the logistic regression analysis.

Table 4.14.1: Logistic Regression Analysis of Factors Influencing Householders' Access to Improved Water for Drinking Based on WHO Definitions.

Explanatory variables	Parameter Estimate	Standard Error	Probability Level of Significance
Intercept	0.955	0.212	0.000**
Gender	0.521	0.132	0.000**
Education	-0.212	0.067	0.001**
Wealth	-0.382	0.046	0.000**
Moslem	-0.419	0.165	0.011**
Locality1 (indigene)	0.120	0.140	0.393
Locality2 (mixed)	0.122	0.180	0.498

**** Statistically significant at the 5% level used for the study.**

The overall percentage correctly classified was 64.9%

4.14.2 Results of Logistic Regression Analysis of Factors Influencing Householders' Access to Improved Water for Other Domestic Purposes.

Based on the definitions of WHO, improved sources of water for other domestic purposes are water piped into dwelling, piped into compound/yard/plot, piped into neighbour, protected wells, protected spring, boreholes, public standpipe and rainwater. Unimproved water for other domestic uses included water from unprotected spring, tanker-truck and cart with small tank.

The results of the logistic regression analysis of factors influencing householders' access to improved water for other domestic purposes are reported in Table 4.14.2. None of the independent variables was statistically significant in influencing the likelihood of using improved water for other domestic uses. In contrast, compared to the results reported in Table 4.12 which were based on the specific definitions of improved water for other domestic uses adopted by this study, four out of the six independent variables were statistically significant (refer to Table 4.12). The lack of significance of any of the six independent variables in the WHO-based model reported in Table 4.14.2 further lends credence to the lack of validity of WHO definitions of improved water as applicable to the study area.

Table 4.14.2: Logistic Regression Analysis of Factors Influencing Householders' Access to Improved Water for Other Domestic Purposes.

Explanatory variables	Parameter Estimate	Standard Error	Probability Level of Significance
Intercept	4.045	1.005	0.000**
Gender	-0.715	0.620	0.248
Education	0.492	0.274	0.073
Wealth	-0.130	0.203	0.523
Moslem	-0.564	0.684	0.409
Locality1 (indigene)	-0.957	0.614	0.119

**** Statistically significant at the 5% level used for the study.**

The overall percentage correctly classified was 98.2%.

4.14.3 Results of Logistic Regression Analysis of Factors Influencing Householders' Access to Improved Toilet Facilities.

The WHO defines improved sources of toilet facilities to include flush to piped sewer system, flush to septic tank, flush to pit latrine, ventilated improved pit, pit latrine with slab while the unimproved toilet facilities are flush to somewhere else, bucket and the bush, fields and beach. Table 4.14.3 reports the results of the logistic regression analysis of factors influencing householders' access to improved toilet facilities. Only the two locality variables are statistically significant in explaining the likelihood of a household using improved toilet facilities. In contrast, as reported in Table 4.13, the comparative logistic regression model using the definitions of improved toilet facilities used in this study showed that all the independent variables, except Muslim, were statistically significant.

In a summary, the results using the definitions developed for this study are different from those of WHO but are more consistent with those reported in the literature. For instance, as reported by Bosch *et al.* (2001) the higher the income and educational level of an individual, the more likely he or she will demand for improved water for drinking and improved sanitation facilities. Yet none of the three WHO-based logistic regression model analytic results reported showed any plausible relationship between income or wealth and likelihood of use of improved water and/or sanitation facilities.

Table 4.14.3: Logistic Regression Analysis of Factors Influencing Householders' Access to Improved Toilet Facility.

Explanatory variables	Parameter Estimate	Standard Error	Probability Level of Significance
Intercept	1.178	0.264	0.000**
Gender	-0.020	0.167	0.903
Education	0.106	0.085	0.212
Wealth	-0.072	0.058	0.216
Moslem	0.340	0.201	0.092
Locality1 (indigene)	0.442	0.172	0.010**
Locality2 (mixed)	1.757	0.345	0.000**

**** Statistically significant at the 5% level used for the study.**

The overall percentage correctly classified was 84.2%.

4.15 Results of Adjusted Logistic Regression Analysis of Factors Influencing Access to Improved Water for Drinking, Improved Water for Other Domestic Uses and Improved Toilet Facilities Using WHO Definitions of Outcome Variables.

In economics science, the choice of the optimal econometric model is based on underlying economic theories and econometric specification (Gujarati, 2003, Chapter 13). In the biological and medical science literature, researchers sometimes use logistic regression analysis to evaluate the best prediction from a set of independent variables and undertake partial comparative analysis of the effects between and among the various independent variables (see for example, the work by Renzaho *et al*. (2007) for Ghana. This is called the adjusted logistic regression analysis and it is used in many cases especially where the causes of a phenomenon such as a disease are unknown and theories are not clear or precise on the causes.

Based on the WHO definitions of improved water and sanitation facilities, adjusted logistic regression analysis was undertaken using the five independent variables: (1) gender, (2) wealth, (3) education level, (4) religion and (5) locality. These variables were expressed strictly as categorical variables similar to the forms used in the chi square analysis of test of association reported earlier. For all the categorical variables, the lowest coded category was the reference. The results of the adjusted logistic regression analysis are reported in Appendix 3 separately for the three outcome measures (improved water for drinking, improved water for other uses and improved toilet facilities). The definitions of the different classes of the five categorical variables used for the adjusted regression analysis are reported in Appendix 4.

CHAPTER 5

SUMMMARY OF FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

The main objective of the study was to establish factors which influenced householders' access to improved water and sanitation facilities in five selected low-income communities in Accra namely, Nima, La, Bubuasie, James Town, Nima and Accra. The study hypotheses were that the level of access to improved water and sanitation was low for households and access to improved water and sanitation facilities by households depended on socio-economic factors such as education, gender, location or migrant status, religious affiliation and income or wealth status.

Simple statistical analysis based on descriptive and frequency analysis, chi-square analysis of association and binary logistic regression analysis were employed to analyse the survey data to reveal underlying relationships to accept or reject hypotheses. The chi-square analysis tested the degree of association among three dependent variables (access to improved water, access to improved water for other purposes and access to improved sanitation) and some selected socio-economic characteristics. The binary logistic regression analysis was used to determine the factors that influence the likelihood of households' access to improved water and sanitation.

5.2 Summary of Findings

Findings from this study showed that occupancy status is mainly through rented apartment and this means a high cost of living for many of the residents as rents in the capital cities are very high. Another finding from the study was that the vast majority of the respondents (95.6%) used unimproved drinking water, per the definition of this study, while per the definition of WHO, about 60.4% used unimproved water sources for drinking. With regards to toilet facility, the proportion of respondents with access to improved facility for the purposes of the study was 34.7% while the corresponding proportion based on WHO definition was 84%.

The chi-square analysis revealed that Wealth and Education were statistically significantly associated with householders' access to improved sources of water for drinking while Education, Wealth, Locality, Religion, and Ethnicity were statistically associated with householders' access to improved toilet facilities. Concerning the results per the definition of WHO, the results also showed that Education and Wealth were statistically significant in influencing householders' access to improved water but only Locality influenced their access to toilet facilities.

The logistic regression analysis results based on the definition of the study showed that income (wealth) was the only independent variable that statistically influenced the likelihood of access and use of improved drinking water. The factors influencing access to water for other uses such as cooking were education, income (wealth) and location of the householder. Compared to migrants, indigenes and people from mixed areas were less likely to have access to improved sources of water for other purposes. The significant factors determining access to improved toilet facilities were education, income (wealth), location and gender. Indigenes and people from mixed background were more likely to have access to improved toilet facilities as compared to

the migrants. Males were less likely to have access to improved toilet facilities as compared to females.

The logistic regression analysis results based on WHO definitions were largely incompatible and inconsistent with economic theories, a priori expectations and findings in the literature. For example, education and income (wealth) were negatively related to the likelihood of household using improved drinking water. Further, the likelihood of using or accessing improved water for other domestic uses could not be explained by any of the six independent variables or socio-economic characteristics used for the study. With regards to the use of improved toilet facilities, the logistic regression analysis based on the WHO definitions showed no links between likelihood of using improved facilities and income or education. In fact, none of the WHO-based logistic regression models showed any plausible relationship between income (wealth) and education and likelihood of use of improved water and/or sanitation facilities.

5.3 Conclusions

Broad-based economic growth and development depend on the health status of the labour force. When the health status of these people is severely affected, it can lead to low productivity and even lead to decline in economic activities. Aside these, the nation's resources will also have to be committed into either providing relief items to flood victims or resourcing the health centers to the neglect of other non-preventable diseases and crucial areas such as improving the various sectors of the economy.

This study shows that the quality of water and sanitation facilities and services is not best. The majority of respondents have limited access to improved water for drinking, they also have to travel elsewhere to search for water as well as incur high cost to buy water for drinking. Access to toilet facilities is even worse as many still resort to unimproved sources such as public toilet facilities and the use of the bucket and open space (bush and fields). These poor environmental conditions lead to incidence of diarrhoea and other sanitation-related diseases because pathogens are easily carried into the food and water bodies.

For a quality health status to be attained there must be improvement in the living environment of the population. There is therefore the need for improvement of infrastructure such as housing, water and sanitation especially in the poor urban localities as they remain the hub of majority of the urban population. Therefore, the problem of poor access to water and sanitation should be seen as complex one which needs the attention and involvement of all stakeholders such as the community members, chiefs and opinion leaders, government and non-governmental agencies as well as civil society groups to effectively and efficiently find lasting solution to it. This is because, when all stakeholders take collective responsibilities to address the issue, then ultimately their contributions will have a greater impact on the water and sanitary conditions as well as the disease burden of the communities and the nation as a whole.

5.4 Recommendations

The root causal factor that creates the problem of inadequacies of people's access to water and sanitation in the urban areas is rural-urban drift. Therefore, there is the need to consciously enforce a balance in the allocation of resources to both urban and rural areas. This is in the sense that, if more resources are channeled to the urban areas, then urban development will keep pace with the ever increasing population thereby reducing the pressure on the few available facilities. In so doing, the rural areas should not be neglected. Upgrading of living conditions in such areas such as making farming attractive can reduce the numbers that keep migrating to the urban areas in search of better and quality services. The reduction in population drifts to the urban areas can contribute to lesser pressure on the already few facilities in the urban and slum areas. This can increase urban householders' access to the facilities and improve their health status which would consequently increase productivity, consumption and income of householders.

The study also revealed that education and wealth are the main determinants of factors influencing access to improved water and sanitation facilities as it empowers householders. There is therefore the need for government to ensure the provision of better, quality and intensified educational programmes on public health and hygiene as well as continue to implement policies to create more job opportunities to absorb the working force. This will empower them and give them the opportunities to understand and contribute to the water and sanitation debate. Aside this, there is the need to also educate and build institutional capacities so that they will be able to cope with the increases in urban growth and manage the pressures that come with the growth in the areas of infrastructure. This is because; through capacity building, the institutions will develop pragmatic measures to curb the challenges such as quality

deficiencies, misallocation of resources and inadequate monitoring and evaluation of the infrastructure.

The solution to improper disposal of solid wastes should not been seen only as the Government's responsibility but also, other community organisations and leaders can help curb the menace. The role of religious authorities for instance in tackling the improper disposal of wastes cannot be overemphasized as the study identified religion as one of the socio-economic characteristics that is statistically significantly associated to access to improved toilet facilities. The platforms of these religious leaders could be used to persuade their followers to change their "negative" behaviours and attitude for the benefit of society as a whole.

Another means of improving access to improved water and sanitation facilities is reforming the water pricing system especially for the urban poor. This is because not until affordability of access to these facilities is ensured, extension of access is of limited use to the poor. Therefore it is imperative to ensure that service quality and prices are within reasonable range for the poor. The government should set a ceiling beyond which no intermediary vendors should be allowed to sell water. Efficient checks should be put in place to arrest and prosecute defaulters.

Furthermore, public housing programmes which incorporate the provision of infrastructure services by landlords should be implemented and enforced. Any landlord without proper water and sanitation facilities for its tenants should be prosecuted. This will go a long way to curb the indiscriminate or open defecation menace as reported from the survey. There is also the need to implement some policies such as "let the polluter pay immediately", as well as "naming and shaming" culprits caught in indiscriminate disposal of waste. Not until the laws are enforced, insanitary modes of waste disposal would not be eliminated or curbed to the barest minimum.

For instance, even though the use of pan latrine is banned, as many as 9.6% of the respondents still employ this method in disposing off their refuse.

The need to change trash into cash as already started by some private companies and the Government of Ghana should be effectively promoted. If this is made attractive, many organizations and companies will join in promoting this initiative. By so doing, employment opportunities will be created for many as they will be involved in picking, bagging and reselling to the organizations or companies involved in processing wastes into useful raw materials through the process of recycling. These are further processed into finished goods such as bags, purse, basket and many more. Also, the capacity of the assembly should be enhanced to ensure waste-separation right from the household levels. By this, each household could be provided with two refuse bins with different colour labels for separation of organic and inorganic waste.

Finally, comparison of the logistic regression results based on the study and that of WHO definitions dealing with improved water and sanitation facilities showed that most of the WHO-based variables were not statistically significant in determining householders' access to improved water and sanitation facilities and the few that were significant had parameter estimates which were inconsistent with economic theories and findings reported in the literature. It is clear that the WHO definitions of improved water and sanitation facilities are too broad and inappropriate for all countries. As such, there is the need for WHO to revise their standard definitions to relevant country-specific indicators with regards to what constitute improved and unimproved water and sanitation facilities. This is because what might be considered improved in one country may not be same in other countries.

APPENDICES

APPENDIX 1: QUESTIONNAIRE USED FOR THE STUDY

GHANA HOUSEHOLD QUESTIONNAIRES ACCRA (2010)

(A) GENERAL INFORMATION

I. Questionnaire No ……

II. Household number ……....

III. Interviewer name and number …….

IV. Date of interview …….

(B) PERSONAL INFORMATION ON RESPONDENTS

Q1. Name of Respondent …….

Q2. Sex: 1) Male 2) Female

Q3. Which locality do you come from…….

1) Bubuashie 2) La 3) James Town 4) Nima 5) Accra Newtown

Q4. What is the total number of household members for your household?

…….

Q5. What is the religion of the head of this household?

11. Catholic
12. Protestant
13. Pentecostal/Charismatic
14. Deeper Life
15. Jehovah Witness
16. SDA
21. Moslem
31. Traditional
31. Spiritualist
96. Other religion (specify)
97. No Religion

Q6. To what ethnic group does the head of this household belong?

11. Akan
12. Ga/Dangme
13. Ewe
14. Guan
15. Gruma
21. Mole Dagbani
22. Grusi
23. Mande
24. Non-Ghanaian
96. Other ethnic group (Specify)

Q7.What is the highest level of education of the household head?

1. None
2. Primary
3. Middle/JSS/JHS
4. Secondary +

Q8. Main material for roofing of building

Natural Roof

11. No roof
12. Thatch/Palm leaf/Raffia
13. Sod

Rudimentary Roof

22. Palm/Bamboo
23.Wood Planks
24. Cardboard/Polythene sheets
25. Mud/mud bricks/earth

Finished Roof

31. Metal sheet or slate/asbestos
32. Parquet/Polished wood
33. Calamine/Cement fibre
34. Ceramics tiles
35. Cement
36. Roofing Shingles
96. Other (specify)

Q9. What type fuel does your household mainly use for cooking?

01. Electricity
02. Liquefied Petroleum Gas (LPG)
04. Biogas
05. Kerosene
07. Charcoal
08. Wood/Firewood
09. Straw/Shrubs/Grass
10. Animal waste
11. Agricultural crop residue/sawdust
95. No food cooked in household
96. Other (specify)

Q10. Does your household have a radio?

1. Yes
2. No

Q11. Does any member of your household own a mobile telephone?

1. Yes
2. No

Q12. What is the occupancy status of your household in this dwelling?

11. Own
12. Rent
13. Squatting
14. Caretaker
15. Mortgaged
16. Family house (without rent)
96. Other (specify)……..

(C) ACCESS AND USE OF WATER AND SANITATION FACILITIES AND SERVICES

Q1.What is the main source of drinking water for members of your household?

11) Piped into dwelling
12) Piped into compound, yard or plot
13) Piped to neighbour
14) Public tap/Standpipe
21) Tube Well, Borehole, Dug-well
31) Protected Well
32) Unprotected well
41) Protected spring
42) Unprotected spring
51) Rainwater collection
61) Tanker-Truck
71) Cart with small tank/drum
81) River/stream
82) Dam, lake, pond, canal, irrigation
92) Sachet water
91) Bottled water
96) Others

Q2. What is the main source of water used by your household for other purposes such as cooking and hand-washing?

11) Piped into dwelling

12) Piped into compound, yard or plot

13) Piped to Neighbour

14) Public tap/Standpipe

21) Tube Well, Borehole, Dug-well irrigation

31) Protected Well

32) Unprotected well

41) Protected spring

42) Unprotected spring

51) Rainwater collection

61) Tanker-Truck

71) Cart with small tank/drum

81) River/stream

82) Dam, lake, pond, canal,

96) Others

Q3. Where is that water source located?

1. In own dwelling
2. In own yard/plot
3. Elsewhere

Q4. How long does it take to go there, get water and come back?

a) 1-5 mins

b) 6-10 mins

c) 11-30

d) N/A

Q5.Who usually goes to this source to collect the water for your household?

11) Adult woman (age 15+ years)

12) Adult man (age 15+ years)

13) Female child (under 15)

14) Male child (under 15)

15) Children (both sexes)

16) Adult women and child (ren)

17) Adult men and child (ren)

Q6. Do you do anything to the water to make it safer to drink?

1) Yes
2) No
8) DK

Q7. What kind of toilet facility do members of your household usually use?

11) Flush to piped sewer system

12) Flush to septic tank

13) Flush to pit (latrine)

14) Flush to somewhere else

15) Flush don't know where

21) Ventilated Improved Pit Latrine (VIP)

22) Pit Latrine with Slab

23) Pit Latrine without slab/Open pit

31) Composting toilet

41) Bucket

51) Hanging toilet, hanging latrine

95) No facility, Bush, Field, Beach

96) Other (specify)

Q8. Do you share this facility with others who are not members of your household?

1. Yes
2. No

Q9. Do you share this facility only with members of other households that you know, r is the facility opened to the use of the general public?

1. Other households only (not public)
2. Public Facility

Q10. How many households in total use this toilet facility, including your own household?

1. Number of households (if less than 10)
2. Ten or more households
3. DK

APPENDIX 2

SPSS PROGRAMMES USED TO ANALYSE SURVEY DATA INCLUDING SIMPLE STATISTICAL, CHI SQUARE AND BINARY REGRESSION ANALYSES BASED ON DEFINITIONS USED IN THIS STUDY FOR IMPROVED WATER AND SANITATION.

2A. SPSS PROGRAMME TO ANALYSE ACCESS TO IMPROVED SOURCE OF DRINKING WATER.

```
GET DATA

/TYPE=XLS

/FILE='c:\mahamathesis\data01.xls'

/READNAMES=ON.

if ws1=11 dwimprov=1.

if ws1=12 dwimprov=0.

if ws1=13 dwimprov=0.

if ws1=14 dwimprov=0.

if ws1=21 dwimprov=0.

if ws1=31 dwimprov=0.

if ws1=32 dwimprov=0.

if ws1=41 dwimprov=0.

if ws1=42 dwimprov=0.

if ws1=51 dwimprov=0.

if ws1=61 dwimprov=0.

if ws1=71 dwimprov=0.

if ws1=81 dwimprov=0.

if ws1=82 dwimprov=0.

if ws1=91 dwimprov=1.
```

```
if ws1=92 dwimprov=0.
if ws1=96 dwimprov=0.
if locality=0 migrant=1.
if locality=2 migrant=0.
if locality=3 migrant=0.
if locality=0 indigene=0.
if locality=2 indigene=1.
if locality=3 indigene=0.
if locality=0 mixed=0.
if locality=2 mixed=0.
if locality=3 mixed=1.
compute nw1549=hh12.
compute nchu5=hh14.
if nchu5=0 nchild=0.
if nchu5>0 nchild=1.
if hc8a=1 elect=1.
if hc8a=2 elect=0.
compute wealth=windex5.
if helevel=1 educ=1.
if helevel=2 educ=2.
if helevel=3 educ=3.
if helevel=4 educ=4.
if gender=1 ngender=1.
if gender=2 ngender=0.
```

```
if HC1A=11 christ=1.
if HC1A=12 christ=1.
if HC1A=13 christ=1.
if HC1A=14 christ=1.
if HC1A=15 christ=1.
if HC1A=16 christ=1.
if HC1A=21 christ=0.
if HC1A=31 christ=0.
if HC1A=32 christ=0.
if HC1A=96 christ=0.
if HC1A=97 christ=0.
if HC1A=11 moslem=0.
if HC1A=12 moslem=0.
if HC1A=13 moslem=0.
if HC1A=14 moslem=0.
if HC1A=15 moslem=0.
if HC1A=16 moslem=0.
if HC1A=21 moslem=1.
if HC1A=31 moslem=0.
if HC1A=32 moslem=0.
if HC1A=96 moslem=0.
if HC1A=97 moslem=0.
if HC1A=11 traditn=0.
if HC1A=12 traditn=0.
if HC1A=13 traditn=0.
```

if HC1A=14 traditn=0.

if HC1A=15 traditn=0.

if HC1A=16 traditn=0.

if HC1A=21 traditn=0.

if HC1A=31 traditn=1.

if HC1A=32 traditn=1.

if HC1A=96 traditn=0.

if HC1A=97 traditn=0.

frequencies variables=ws1 dwimprov educ ngender religion ethnicity wealth nchu5 locality nw1549 elect educ migrant mixed indigene christ moslem traditn hc6 hc8b hc8c1 hc10 hc4 hc9b WS3 WS5 WS4.

descriptives variables=dwimprov ngender wealth nchu5 nw1549 elect educ migrant mixed indigene christ moslem traditn nchild hc6 hc8b hc8c1 hc10 hc4 hc9b WS3 WS5 WS4.

crosstabs tables = dwimprov by ngender/cells=row column/statistics=chisq.

crosstabs tables = dwimprov by educ/cells=row column/statistics=chisq.

crosstabs tables = dwimprov by wealth/cells=row column/statistics=chisq.

crosstabs tables = dwimprov by ethnicity/cells=row column/statistics=chisq.

crosstabs tables = dwimprov by religion/cells=row column/statistics=chisq.

crosstabs tables = dwimprov by locality/cells=row column/statistics=chisq.

logistic regression dwimprov with ngender educ wealth moslem indigene mixed.

2B. SPSS PROGRAMME TO ANALYSE ACCESS TO IMPROVED WATER FOR OTHER DOMESTIC USES SUCH AS COOKING.

```
GET DATA
/TYPE=XLS
/FILE='c:\mahamathesis\data01.xls'
/READNAMES=ON.
if ws2=11 woimprov=1.
if ws2=12 woimprov=1.
if ws2=13 woimprov=1.
if ws2=14 woimprov=0.
if ws2=21 woimprov=0.
if ws2=31 woimprov=0.
if ws2=32 woimprov=0.
if ws2=41 woimprov=0.
if ws2=42 woimprov=0.
if ws2=51 woimprov=1.
if ws2=61 woimprov=0.
if ws2=71 woimprov=0.
if ws2=81 woimprov=0.
if ws2=82 woimprov=0.
if ws2=96 woimprov=0.
if ws1=96 dwimprov=0.
if locality=0 migrant=1.
if locality=2 migrant=0.
```

```
if locality=3 migrant=0.
if locality=0 indigene=0.
if locality=2 indigene=1.
if locality=3 indigene=0.
if locality=0 mixed=0.
if locality=2 mixed=0.
if locality=3 mixed=1.
compute nw1549=hh12.
compute nchu5=hh14.
if nchu5=0 nchild=0.
if nchu5>0 nchild=1.
if hc8a=1 elect=1.
if hc8a=2 elect=0.
compute wealth=windex5.
if helevel=1 educ=1.
if helevel=2 educ=2.
if helevel=3 educ=3.
if helevel=4 educ=4.
if gender=1 ngender=1.
if gender=2 ngender=0.
if HC1A=11 christ=1.
if HC1A=12 christ=1.
if HC1A=13 christ=1.
if HC1A=14 christ=1.
if HC1A=15 christ=1.
```

if HC1A=16 christ=1.

if HC1A=21 christ=0.

if HC1A=31 christ=0.

if HC1A=32 christ=0.

if HC1A=96 christ=0.

if HC1A=97 christ=0.

if HC1A=11 moslem=0.

if HC1A=12 moslem=0.

if HC1A=13 moslem=0.

if HC1A=14 moslem=0.

if HC1A=15 moslem=0.

if HC1A=16 moslem=0.

if HC1A=21 moslem=1.

if HC1A=31 moslem=0.

if HC1A=32 moslem=0.

if HC1A=96 moslem=0.

if HC1A=97 moslem=0.

if HC1A=11 traditn=0.

if HC1A=12 traditn=0.

if HC1A=13 traditn=0.

if HC1A=14 traditn=0.

if HC1A=15 traditn=0.

if HC1A=16 traditn=0.

if HC1A=21 traditn=0.

if HC1A=31 traditn=1.

if HC1A=32 traditn=1.

if HC1A=96 traditn=0.

if HC1A=97 traditn=0.

frequencies variables=ws2 woimprov educ ngender religion ethnicity wealth nchu5 locality nw1549 elect educ migrant mixed indigene christ moslem traditn hc6 hc8b hc8c1 hc10 hc4 hc9b WS3 WS5 WS4.

descriptives variables=woimprov ngender wealth nchu5 nw1549 elect educ migrant mixed indigene christ moslem traditn nchild hc6 hc8b hc8c1 hc10 hc4 hc9b WS3 WS5 WS4.

crosstabs tables = woimprov by ngender/cells=row column/statistics=chisq.

crosstabs tables = woimprov by locality/cells=row column/statistics=chisq.

crosstabs tables = woimprov by wealth/cells=row column/statistics=chisq.

crosstabs tables = woimprov by ethnicity/cells=row column/statistics=chisq.

crosstabs tables = woimprov by religion/cells=row column/statistics=chisq.

crosstabs tables = dwimprov by educ/cells=row column/statistics=chisq.

logistic regression woimprov with ngender educ wealth moslem indigene mixed.

2C. SPSS PROGRAMME TO ANALYSE ACCESS TO IMPROVED SOURCE OF TOILET FACILITY

```
GET DATA
/TYPE=XLS
/FILE='c:\mahamathesis\data01.xls'
/READNAMES=ON.
if ws8=11 TFimprov=1.
if ws8=12 TFimprov=1.
if ws8=13 TFimprov=0.
if ws8=14 TFimprov=0.
if ws8=15 TFimprov=0.
if ws8=21 TFimprov=0.
if ws8=22 TFimprov=0.
if ws8=22 TFimprov=0.
if ws8=31 TFimprov=0.
if ws8=41 TFimprov=0.
if ws8=51 TFimprov=0.
if ws8=95 TFimprov=0.
if ws8=96 TFimprov=0.
if locality=0 migrant=1.
if locality=2 migrant=0.
if locality=3 migrant=0.
if locality=0 indigene=0.
if locality=2 indigene=1.
if locality=3 indigene=0.
if locality=0 mixed=0.
if locality=2 mixed=0.
if locality=3 mixed=1.
compute nw1549=hh12.
compute nchu5=hh14.
if nchu5=0 nchild=0.
```

```
if nchu5>0 nchild=1.
if hc8a=1 elect=1.
if hc8a=2 elect=0.
compute wealth=windex5.
if helevel=1 educ=1.
if helevel=2 educ=2.
if helevel=3 educ=3.
if helevel=4 educ=4.
if gender=1 ngender=1.
if gender=2 ngender=0.
if HC1A=11 christ=1.
if HC1A=12 christ=1.
if HC1A=13 christ=1.
if HC1A=14 christ=1.
if HC1A=15 christ=1.
if HC1A=16 christ=1.
if HC1A=21 christ=0.
if HC1A=31 christ=0.
if HC1A=32 christ=0.
if HC1A=96 christ=0.
if HC1A=97 christ=0.
if HC1A=11 moslem=0.
if HC1A=12 moslem=0.
if HC1A=13 moslem=0.
if HC1A=14 moslem=0.
if HC1A=15 moslem=0.
if HC1A=16 moslem=0.
if HC1A=21 moslem=1.
if HC1A=31 moslem=0.
if HC1A=32 moslem=0.
if HC1A=96 moslem=0.
if HC1A=97 moslem=0.
```

```
if HC1A=11 traditn=0.
if HC1A=12 traditn=0.
if HC1A=13 traditn=0.
if HC1A=14 traditn=0.
if HC1A=15 traditn=0.
if HC1A=16 traditn=0.
if HC1A=21 traditn=0.
if HC1A=31 traditn=1.
if HC1A=32 traditn=1.
if HC1A=96 traditn=0.
if HC1A=97 traditn=0.
crosstabs tables = TFimprov by educ/cells=row column/statistics=chisq.
crosstabs tables = TFimprov by ngender/cells=row column/statistics=chisq.
crosstabs tables = TFimprov by locality/cells=row column/statistics=chisq.
crosstabs tables = TFimprov by wealth/cells=row column/statistics=chisq.
crosstabs tables = TFimprov by ethnicity/cells=row column/statistics=chisq.
crosstabs tables = TFimprov by religion/cells=row column/statistics=chisq.
frequencies variables=ws8 TFimprov educ ngender religion ethnicity wealth nchu5 locality nw1549 elect educ migrant mixed indigene christ moslem traditn nchild.
descriptives variables=TFimprov ngender wealth nchu5 nw1549 elect educ migrant mixed indigene christ moslem traditn nchild.
logistic regression TFimprov with ngender educ wealth moslem indigene mixed.
```

APPENDIX 3: RESULTS OF LOGISTIC ANALYSIS OF FACTORS INFLUENCING HOUSEHOLDERS' ACCESS TO IMPROVED WATER AND SANITATION BASED ON WHO'S DEFINITION.

APPENDIX 3A: ACCESS TO IMPROVED DRINKING WATER

Parameter Estimates

Independent Variables	B	Std. Error	Sig.	Exp(B)
Intercept	2.031	0.348	0.000	
[Gender=1]	-0.537	0.137	0.000	0.585
[Gender=2]	-	-	-	-
[windex5=1]	-1.412	0.212	0.000	0.244
[windex5=2]	-1.276	0.206	0.000	0.279
[windex5=3]	-0.495	0.206	0.016	0.610
[windex5=4]	-0.198	0.209	0.345	0.820
[windex5=5]	-	-	-	-
[helevel=1]	-0.774	0.212	0.000	0.461
[helevel=2]	-0.187	0.234	0.425	0.830
[helevel=3]	-0.411	0.144	0.004	0.663
[helevel=4]	-	-	-	-
[religion=1]	-0.356	0.255	0.164	0.701
[religion=2]	0.089	0.288	0.757	1.093
[religion=3]	-	-	-	-
[Locality=0]	0.112	0.182	0.539	1.118
[Locality=2]	-0.043	0.179	0.810	0.958
[Locality=3]	-	-	-	-

Note:

- Statistical Significance is between householders with access to improved drinking water and those without access (* for $p<0.01$), (** for $p<0.05$) and (*** for $p < 0.1$).
- Final model fitting: - 2 log likelihood= 504.989 Chi-square = 135.449 Sig. (P-Value) = 0.000
- See Appendix 4 for the definition of variables in the Tables.

APPENDIX 3B: ACCESS TO IMPROVED WATER FOR OTHER DOMESTIC PURPOSES

Parameter Estimates

Independent Variables	B	Std. Error	Sig.	Exp(B)
Intercept	-22.369	1.371	0.000	
[Gender=1]	0.679	0.628	0.000**	1.972
[Gender=2]	-	-	-	-
[windex5=1]	-0.716	0.969	0.460	0.489
[windex5=2]	0.174	0.780	0.823	1.191
[windex5=3]	-0.903	0.904	0.318	0.405
[windex5=4]	-0.474	0.797	0.551	0.622
[windex5=5]	-	-	-	-
[helevel=1]	1.559	0.788	0.048**	4.752
[helevel=2]	-17.157	6132.095	0.571	3.54E-08
[helevel=3]	0.382	0.673	0.998	1.465
[helevel=4]	-	-	-	-
[religion=1]	0.134	1.127	0.815	1.144
[religion=2]	0.290	1.238	0.905	1.337
[religion=3]	-	-	-	-
[Locality=0]	17.556	0.653	0.000**	4.21E+07
[Locality=2]	18.275	0.000	-	8.65E+07
[Locality=3]	-	-	-	

- Statistical Significance is between householders with access to improved drinking water and those without access (* for p<0.01), (** for p<0.05) and (*** for p < 0.1).
- Final model fitting : - 2 log likelihood= 76.464 chi-square = 16.296 sig. = 0.178
- See Appendix 4 for the definition of variables in the Table.

APPENDIX 3C: ACCESS TO IMPROVED TOILET FACILITIES

Parameter Estimates

Independent Variables	B	Std. Error	Sig.	Exp(B)
Intercept	-2.61	0.484	0.000	
[Gender=1]	-0.073	0.173	0.674	0.930
[Gender=2]	-	-	-	-
[windex5=1]	-0.162	0.278	0.560	0.851
[windex5=2]	-0.275	0.276	0.319	0.759
[windex5=3]	0.111	0.256	0.663	1.118
[windex5=4]	0.345	0.253	0.174	1.411
[windex5=5]	-	-	-	-
[helevel=1]	0.216	0.275	0.432	1.241
[helevel=2]	0.163	0.306	0.595	1.177
[helevel=3]	0.385	0.188	0.041**	1.469
[helevel=4]	-	-	-	-
[religion=1]	-0.654	0.297	0.027**	0.520
[religion=2]	-0.861	0.336	0.010**	0.423
[religion=3]	-	-	-	-
[Locality=0]	1.776	0.347	0.000**	5.904
[Locality=2]	1.228	0.353	0.001**	3.413
[Locality=3]	-	-	-	-

- Statistical Significance is between householders with access to improved drinking water and those without access (* for p<0.01), (** for p<0.05) and (*** for p < 0.1).
- Final model fitting: - 2 log likelihood= 404.530 Chi-square = 53.481 Sig. (P-Value) = 0.000
- See Appendix 4 for the definition of variables in the Table.

APPENDIX 4: DEFINITION OF VARIABLES USED IN LOGISTIC REGRESSION ANALYSIS SHOWN IN APPENDIX 3.

Variables	Definitions
[Gender=1]	Male
[Gender=2]	Female
[windex5=1]	Poorest Wealth Quintile
[windex5=2]	Second Poorest Wealth Quintile
[windex5=3]	Third Poorest Wealth Quintile
[windex5=4]	Fourth Poorest Wealth Quintile
[windex5=5]	Richest Wealth Quintile
[helevel=1]	No Form of Education
[helevel=2]	Primary Education
[helevel=3]	Middle or JHS
[helevel=4]	Secondary and above
[religion=1]	Christian
[religion=2]	Muslim
[religion=3]	Traditional/ Spiritual
[Locality=0]	Migrants
[Locality=2]	Indigenous
[Locality=3]	Mixed

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