# KWAME NKURUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY, KUMASI, GHANA

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## IMPACT OF SHARED SANITATION TOILETS ON CANDIDIASIS INFECTION AMONG FEMALES IN AUCHI COMMUNITY, EDO STATE, NIGERIA.

**By**

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A Thesis Submitted to the Department of Civil Engineering, College of Engineering

In partial fulfilment of requirements for the Degree of

**MASTER OF SCIENCE**

**Water Supply and Environmental Sanitation**

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## DECLARATION

I hereby declare that this is my own work towards the Master of Science (MSc) degree in Water Supply and Environmental Sanitation and that, to the best of my knowledge, it contains no material previously published by another person nor material which has been accepted for the award of any other degree of the University, except where due acknowledgement has been made in the text.

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## ABSTRACT

This study focused on the incidence of Candidiasis infection among females as it relates to shared sanitation toilets in educational institutions and domestic facilities in Auchi community of Edo State, Nigeria. Toilets and high vagina swab samples were analysed for the presence of Candida Albicans and the association with shared toilet. The laboratory investigation for the assessment of the presence of Candida Albicans used samples from squat holes, the walls, floors and handles of the shared sanitation toilet facilities and cultured at $37^0$c for 24 hours and 48 hours. Results revealed that Candida Albicans were present in some shared sanitation toilets of both educational and domestic facilities in Auchi community. The high vagina swab samples revealed positive cases of candidiasis infection (22.73%) among females in the study area. The analysis of the use of toilets revealed that single household latrine was 46.8%. Shared household latrine 35.1% and shared neighbourhood latrine 18%; shared public latrine was not visible in the study area. Water closet stood out as being the type of toilet mostly used at home. Results of the investigation of the rate of usage and frequency of cleaning reveal that the females frequently use and clean the toilet facilities, though majority of the toilets physically inspected were in bad state; dirty and odorous. Suffice to say that Auchi community rely heavily on individuals‟ bore hole and water vendors for their sources of water supply. There is a near absence of water utility in Auchi; this has impacted negatively on the sanitary conditions of the toilets and the choice of toilets currently being used. It is worthy to note that all respondents who practice open field defecation buy water from water vendors. The investigation of the effect of candidiasis infection on work and daily life of the respondents indicated statistical significance (0.000) at 99% confidence interval. This finding showed that there is very strong evidence that toilet infection can affect work and daily life of those infected.


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NYANSAPƆ WƆ SANE NO BADWENMA

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## DEDICATION

This research is dedicated to God the father Almighty creator of heaven and earth.

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# CHAPTER 1: INTRODUCTION

## 1.1 General Background

The National Water Supply and Sanitation Policy (2000) emphasizes – in accordance with the Millennium Development Goals - the provision of sufficient potable water and adequate sanitation to all Nigerians in an affordable and sustainable way through a cost sharing formula on investment and operational costs between government and the beneficiary. The rapid population growth in Nigeria has not been accompanied by an increase in the delivery of water supply, sewerage and sanitation services in most areas of the country. In recent time, the gap between those areas that have reasonably safe access to water supply and sanitation (WSS) and those without is growing wider. Urban areas experience greater coverage, whereas peri-urban, semi-urban, and rural areas are at best experiencing stagnation or worst still, a decline in service. This regardless of the fact that, Nigeria‟s water infrastructure has suffered from years of poor operation and maintenance (O&M), and the very low access to improved sanitation by the majority of Nigerians, constitutes a serious public-health problem.

Environmental health conditions of shared sanitation toilets continue to be a source of infections such as Candidiasis. After the International Drinking Water Supply and Sanitation Decade (1981-1990) when significant progress was made in water supply and sanitation coverage, in some part of the world, the proportion of people with access to adequate water and sanitation has not sufficiently increased to meet the Millennium Development Goals (MDGs) . This has been attributed to population growth, insufficient continued investment and lack of training and spares to maintain systems in working order. Progress towards reaching the goals has been uneven since some countries such as China and India have achieved many of the goals while others are still on track to realize some. Environmental health conditions of shared sanitation toilets in institutions and those for public use are not desirable due to factors such as crowded living space.

With crowded living space, diseases spread easily due to the fact that so many people tend to use a particular toilet. Females are more vulnerable to these infections from shared toilets. An infection such as Candidiasis is mostly common in females. Candidiasis, also called invasive infection, yeast infection or thrush is a common fungal infection that occurs when there is overgrowth of the fungus called Candida Albicans. According to Lori, 2015, Candida is always present in the body and in small amounts. However, when an imbalance occurs, such as when the normal acidity of the vagina changes or when hormonal balance changes, Candida can multiply. Yeast infections usually occur in warm, moist parts of the body, such as the mouth and moist areas of skin. When they cause an infection in the vagina, it is called **Vulvo Vagina Candidiasis (VVC).**

Candidiasis is reported to have been around for thousands of years, but it is only since the advent of antibiotics that it has become in essence an epidemic. The incidence of such fungal infections has increased 11 fold over the past 15 years. Antibiotics are a major factor in the development of Candidiasis because they kill off the friendly bacteria in our systems that keep the common yeast, Candida Albicans, under control. When the Candida yeast overgrows its bounds, it can cause a variety of symptoms that can range from general fatigue, gas, bloating, diarrhoea and frequent vagina infections in women.

The research seeks to address the vulnerability of most females to Candidiasis infection. The infection is common among females and it is a common believe that it is related to toilets in bad conditions. The infection is also common among female students in schools, and this is also linked to public toilets. It can be said from my preliminary interview with students, that among every four people in a room in educational institutions at least one person has or had the infection. This is an indication of how widespread the problem is. The possible causes of the infection may be:

- Use of infected toilet facilities.

- Clothing (especially underwear) that is too tight or made of materials like nylon. Nylon trap heat and moisture, this can lead to yeast infections since yeast can thrive in this type of environment.
- Washing vagina with soap and using scented sanitary products, these can upset the healthy balance of bacteria in the vagina and make yeast infections more likely to proliferate.
- Oral antibiotics kill off the good bacteria in the intestine, and this allows Candida to multiply,
- Use of oral contraceptives, antacids, and anti-ulcer medications.
- Having a repressed immune system due to medication or disease.

Majority of females whether educated or not believe that washing vagina with soaps protects them from infections and also prevent odour. The problem is that the affected people are normally uncomfortable as they experience itching and irritation in the vagina, and pain or burning sensation when urinating or during sex. It is against this background that the study is being carried out to find out the link between sanitation and the infection.

**1.2 Research Objectives**

The main objective of this research is to assess incidence of Candidiasis infection as it relates to shared sanitation toilets in educational institutions and domestic facilities and also the risk factors of Candidiasis infection related to shared sanitation toilets by comparing those with and without infections.

The specific objectives include the following:

1. To analyse the presence of Candida Albicans in toilets and high vagina swab samples.
2. To assess the types of toilet, rate of usage, frequency of cleaning and the hygienic conditions of shared sanitation toilets.

3. To assess the factors likely to contribute to Candidiasis infection among females and the effect of the infection on the work and daily life of those who are infected.

### 1.3 Justification of Research

There is need to have a reliable data bank for discussion of the importance of sanitation and hygiene for health and development especially in developing countries such as Nigeria. It is therefore important to carry out a comprehensive study on the impact of shared sanitation toilets on Candidiasis infection in females.

Investment in water supply and sanitation can yield to net economic benefit (WHO, 2006), since the reduction in adverse health effects and health care costs outweigh the costs of undertaking the interventions. Experience has shown that interventions in improving access to safe water and sanitation favour the poor in particular, whether in rural or urban areas, and can be an effective part of poverty alleviation strategies. The success of the study will contribute useful data needed for the planning and advocating the needs of the communities.

### 1.4 Scope of the Study

The research will be limited to females who share toilets facilities in Auchi educational institutions and domestic community. Both dry systems (pit latrine) and wet systems (septic tank-based toilets) will be investigated for toilets conditions and the prevalence of Candida Albicans in toilet and high vagina swab samples from volunteers within the age of 13years and 60 years.

## CHAPTER 2: LITERATURE REVIEW

### 2.1 Development Goals and Environmental Sustainability

2.1. 1 Millennium Development Goals and Environmental Sustainability

The millennium development goal number seven, goal target number ten, are aimed at ensuring environmental sustainability and to halve, by 2015, the proportion of people without

sustainable access to safe drinking-water and basic sanitation. This target to halve the proportion of people who lack access to basic sanitation and water supply by 2015 was an agreement by the International Community at the World Summit on Sustainable Development (WSSDs) held in Johannesburg in 2002.Water supply and sanitation are very critical and central to improvements in so many aspects of human development, health, education, urban and rural development, development of industry and general economic development, (FRN, 2000). It is for this reason that the National Water Supply and Sanitation Policy (2000) emphasizes – in accordance with the Millennium Development Goals - the provision of sufficient potable water and adequate sanitation to all Nigerians in an affordable and sustainable way through a cost sharing formula on investment and operational costs between government and the beneficiary. A careful balance between affordable tariffs especially for the poor and a high degree of cost recovery is a real challenge for the implementation of the policy to provide sufficient potable water and adequate sanitation to all Nigerians. According to Antonio (2005), more than 1.2 billion people in the world still lack access to safe drinking water and 2.6 billion lack accesses to even basic sanitation. In a Water Aid 2012 report, seven in ten that is 70% of women in Nigeria have no access to a safe toilet, with 40% defecating in the open; threatening their health, security and exposing them to shame, fear and even violence. The survey conducted on women living across five slums in Lagos (Ajegunle, Ijora, Badia, OkoAgbon and Otto-Oyingbo), Nigeria, showed that one in five (20%) had first or second hand experience of verbal harassment and intimidation, or had been threatened or physically assaulted in the last year when going to the toilet.

When women don‟t have a safe, clean, secure and private place to go to the toilet, they are exposed and put in a vulnerable position and when they relieve themselves in the open they risk intimidation and harassment. Women are reluctant to talk about it or complain, but the world cannot continue to ignore this. The lack of such essential services creates a massive crisis for developing countries – undermining health systems, education, economic development, and

progress on gender equality. Poor water, sanitation and hygiene are costing Nigeria around N455 billion that is about 1.3% of its GDP each year, WSP (2012).

According to UNDP (2013), Progress on MDG 7, 'Ensuring environmental sustainability", in Nigeria is generally slow. At 57.40%, this falls short of the 2015 target of 77.0% on access to clean water. The outlook for access to improved sanitation is not different, currently at 33.70% as against the 2015 target of 70.0%, remains a significant challenge. Similarly, the report has it that about 42.60% of Nigerians had access to improved toilet/latrine facilities in 2010, as against the 2015target of 70.0%. Deforestation and gas flaring has continued to pose major risks to environmental sustainability as does the growing urban slum population. There is therefore, the need for government to strengthen existing national institutional mechanisms, such as the Ecological Fund, the Environmental Impact Assessment Law and the National Environmental Standards and Regulations Enforcement Agency to achieve targets set for the environment. In addition, efforts must be made to improve data collection and reporting with regards to the environment for more efficient and objective future assessments and intervention.

### 2.1.2 Sustainable Development Goals

Sustainable Development Goals (SDGs) goal 6.2 by 2030 seeks to achieve an adequate and equitable sanitation and hygiene for all, paying special attention to the needs of women and girls, and the vulnerable.

### 2.1.3 The Need for Improved Sanitation and Hygiene Practices

Sanitation and human health are closely connected to each other. The lack of treatment for these organic materials before disposal pollutes the environment with organisms that are hazardous to human health. Pathogens can be transmitted by direct contact to human excreta, contaminated water and food, through contact with animals acting as hosts for parasites and pathogenic bacteria and in the case of some helminthes worms infections, directly through the skin, ingestion of faecal pathogens can cause diarrheal disease, cholera, intestinal worms

infections and typhoid fever with children being the most susceptible. Consequently, it is important to safeguard adequate sanitation and hygiene education to reduce the amounts of infections (Huuhtanen and Laukkanen, 2006). The most effective way to break the cycle of diseases is by improving sanitation coverage and hygiene practices.

## 2.2 Types of Toilet and their Suitability

Toilet types can generally be grouped into two categories; off-site and on-site systems (Niall, 2008). Off-site systems are associated more with the developed world, cities and high density areas and often take on the form of sewerage systems which require a reliable water supply and the provision of wastewater treatment. On-site sanitation systems are more widely employed in low income and rural areas of the world. Numerous forms have been developed ranging in both price and complexity. A simple pit latrine is perhaps the simplest and the first step among sanitation solution identified by the United Nations to meet the criteria of the Millennium Development Goals (JMP, 2004).

In order to construct a sewerage network each property should have a toilet, the contents of which discharge to a household connection sewer, which will often include an inspection chamber to clear blockages. The waste will then discharge to a main sewer, on which manholes should be installed at set intervals. The size of the sewer pipes will get progressively larger until the waste is discharged to a treatment works; the sludge by-product from this will require further treatment.

Depending on the types of latrine adopted the cost to the householder may be (relatively) much less than with off-site systems and would generally be covered in one lump sum for the construction of the facility (although the cost of emptying can be large in some cases). Each latrine type will provide both advantages and disadvantages, and are generally more appropriate for rural areas. Odour, flies and the need for emptying are the most important considerations associated with on-site systems.

2.2.1 Simple Pit Latrine

The simplest form of pit latrine (Fig.2.1) is a hand dug pit that is unlined and covered with a series of wooden logs strapped together allowing the user to defecate into the pit. This system can gradually be improved. During the 1980s the Ventilated Improved Pit (VIP) Latrine was developed in Zimbabwe. The main drivers for design were to eliminate two unpleasant aspects of using on-site sanitation systems, flies and smell. Furthermore, the reduction of flies can also reduce the transmission of disease. Put simply, the technology facilitates the flow of air through the system. One important aspect is that the inside of the toilet should remain dark as means of attracting flies up a vent pipe where they will eventually die and fall back into the latrine.

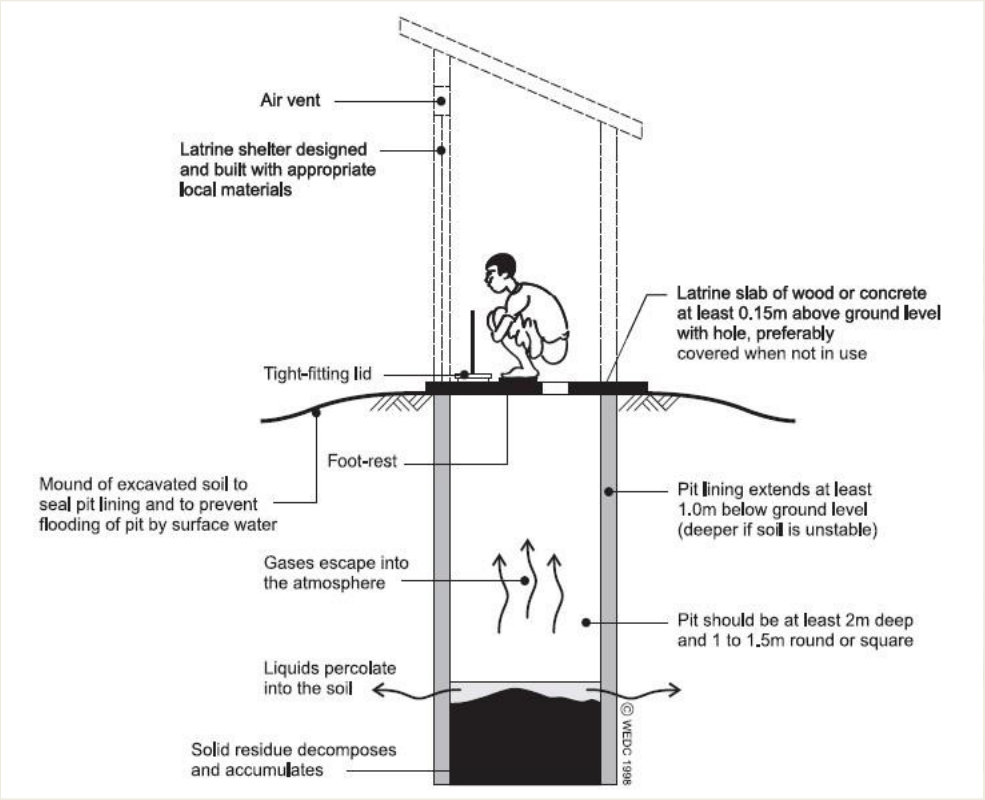



**Figure 2.1. A simple pit latrine (Source: Boot, 2008)**

2.2.2 Pour-Flush Latrine

Pour-flush latrines are reported to be mostly used where water is more widely available, or traditionally used for anal cleansing, a pour flush latrine may be appropriate and can bring a number of further benefits on top of simple or VIP latrines. A water-seal is created by a plastic

u-bend which prevents bad odour and flies affecting the user. The system only requires a few litres of water and so should not put a strain on resources and could be provided by grey waters from the kitchen. Figure 2.2 shows varieties of pour-flush latrine.

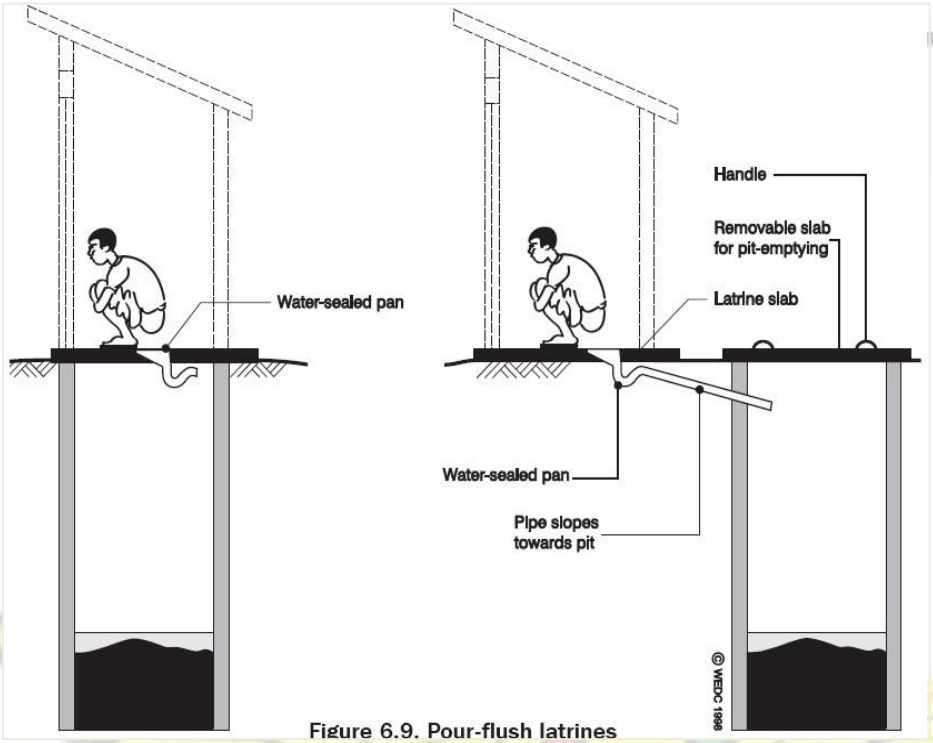



**Figure 2.2. A pour-flush latrine set over a pit latrine (left) and discharging to an offset pit (right) (Source: Boot, 2008)**

2.2.3 Ecological Sanitation Latrines

Ecological sanitation (ecosan) latrines have been developed employing the concept that human waste contains nutrients that should be returned to the soil and used to grow more food. There are different types of toilet, which treat the waste to some extent prior to using the by-product to increase fertility of land. The types of toilet can be split into dehydrating and composting types with urine diversion often being employed to make the most of the nutrients available. Ecosan latrines recognise urine and faeces as useful by-products which can provide users with a cheap fertiliser and soil conditioner.

2.2.4 Aqua-Privy

An aqua-privy function in a similar manner to a septic tank whilst avoiding the need for a consistent water supply to operate a flush toilet, see Fig.2.3. The water will drain off the top and the sludge needs to be emptied on a regular basis. An advantage of the aqua privy is that it reduces odours. However, regular emptying could become an onerous requirement.

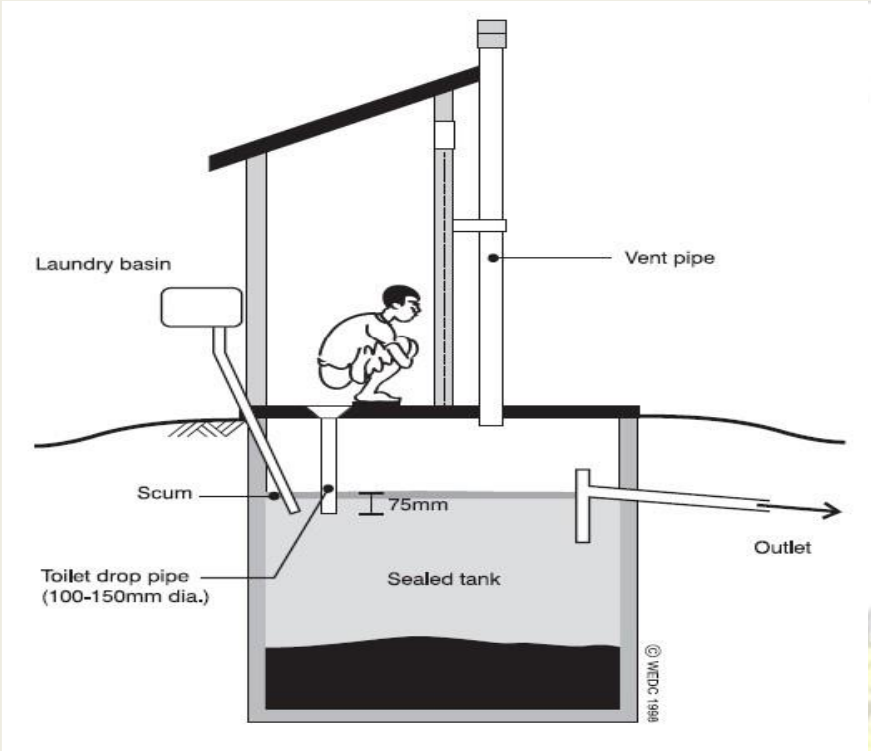



**Figure 2.3. An Aqua Privy (Source: Boot, 2008)**

2.2.5 Septic Tanks

A septic tank is a water tight tank that typically receives waste from a flush toilet, see Fig. 2.4. They are useful in areas with a high water table (due to the sealed nature contamination of the water table is less likely) and when a reliable water supply is present. The system provides some level of treatment to the waste through the separation of solids. The tank is emptied routinely to ensure effluent does not contain unsafe levels of pathogens and that the sludge does not occupy too high a proportion of the tank.

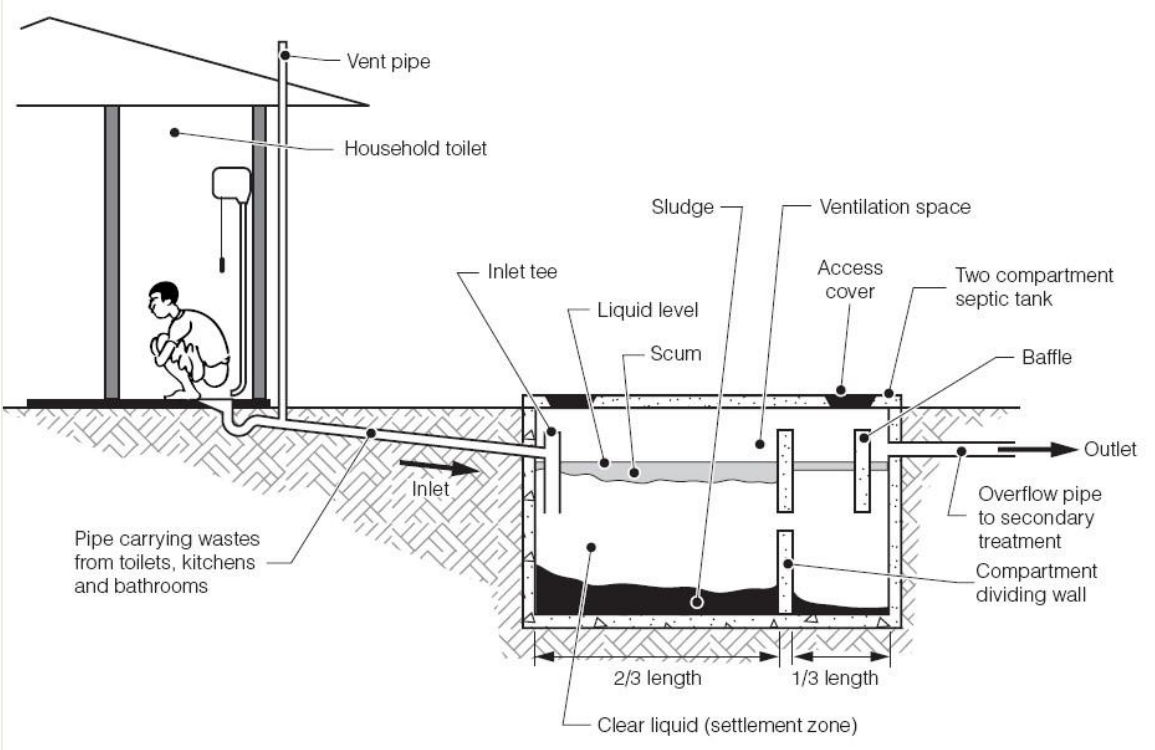



**Figure 2.4. Septic tank layout (Source: Boot, 2008)**

## 2.3 Conditions of Public Sanitary Facilities

The conditions of sanitary facilities in most institutions of learning is not much different from what one encounter in other public places, they are characterized by dysfunctional and poor sanitary conditions that could result in the spread of diseases (Eromosele, 2012) „„Some of the toilets had been turned into residential places, meat stalls, Indian hemp smoking joints and places for commercial food vendor to sell hot rice among other uses. „An investigation reported by Weekly Trust and icirnigeria.org shows that many students in the Federal Capital Territory, FCT, practice open field defecation because their schools do not have sanitation toilets", thus exposing them to harassment, intimidations and serious health risk, .

The World Health Organisation, WHO/United Nations Children Fund, UNICEF, Joint Monitoring Report 2012 defines open field defecation as „a practice whereby a person defecates in an open area that is not meant for that purpose." It also points out that "an improved sanitation facility is one that hygienically separates human excreta from human contact."

According to Jan Elias son, United Nations, UN, deputy secretary-general in his remarks during 2014 World Toilets Day, "The challenge of providing education of good quality cannot truly be achieved in a debased and unsanitary environment and sanitation goes beyond merely ensuring that one"s surrounding is not littered with refuse; it also refers to conditions relating to public health, such as the availability of clean drinking water and adequate sewage disposal," (Opeyemi and Kevwe, 2015).

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**2.4 Toilet Related Infections**

Studies on toilet facilities have shown that people are reluctant to use shared toilets because of the poor sanitary conditions (Haines et al., 2000). Some people avoid the toilet because it is unpleasant, dirty, smelly, not private enough, lack basic hand washing and drying facilities. Health effects caused by bad toilet habits are constipation, bladder infections and urinary tract infection. In the long term, these can contribute to serious illnesses, such as kidney disease. The resulting constipation can also cause ill effects, such as tiredness, headaches, and difficulty in concentrating.

Some organisms that could be acquired by contact with toilet are the Streptococcus and Staphylococcus bacteria that we routinely carry on our skin. One could become a carrier after sharing a toilet with someone carrying that organism. However, the risk of such transmission is very small.

There are organisms on our skin, mouth, gastrointestinal tract (guts) and in the case of inflammation of any part of the body. Candidiasis on skin, may affect the external surface skin and the skin of the vagina, and the mouth. Candidiasis may also infect the blood stream or internal organs such as the liver or spleen. By far the most common problems are skin, mouth and vagina infections. Antibiotic is a contributing factor in the development of Candidiasis because antibiotics kill off the common yeast, Candida Albicans. When the Candida yeast overgrows its bounds, it causes a variety of symptoms that can range from general fatigue, gas,

bloating, diarrhoea, and frequent vagina infections in women. In fact, the Candida Albicans yeast is present in varying amounts in the body, living in our

gastrointestinal tract. It is also connected with the use of oral contraceptives, drugs used for ulcers or even too much sugar in the diet.

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## 2.5 Interventions to Improve Sanitation and Hygienic Practices

Obviously, an improved conditions and advocacy is required in order to improve sanitation and hygienic practices and to help in the achievement of MDGs and sustainability in the field of waste management.

### 2.5.1 Hygiene Promotion

Hygiene promotion is the planned, systematic attempt enabling people to take action to prevent or mitigate water and sanitation related diseases (Burnham and Abdullah, 2008). Hygiene promotion encourages people to practice simple and safe hygiene to replace their unhygienic practices. In many parts of the developing world these practices are not traditionally seen as ways to prevent disease and therefore must be actively promoted within water and sanitation projects (Netherland Water Partnership, 2010). The construction of sanitation facilities and their accessibility does not guarantee they will be used or that they will be used properly. Hygiene promotion tries to ensure that people gain the greatest health benefits possible from these facilities through the proper use and maintenance of the facilities and by improving hygiene practices (Burnham and Abdallah, 2008). The first generation of hygiene improvement programmes consisted of top-down communication and educational activities that mainly addressed the link between good hygiene and better health. This is known as hygiene education (Netherland Water Partnership, 2010). The provision of information on health alone is not sufficient to change people‟s practices. It is important to understand what motivates people to make healthy choices and what motivates them to change their behaviour. The desire for good health is often not the primary motivating factor for change but factors

such as convenience, social status, the esteem of others and financial gain might be the driving forces behind change (Burnham and Abdallah, 2008). Hygiene promotion ideally, builds upon the knowledge, behaviour and benefits that people already have.

### 2.5.2 Cleaning of Sanitation Facilities

Cleaning of the toilets is important to prevent odours and make them socially acceptable. Cleaning should be clearly defined and appropriately carried out. When sanitation facilities are dirty, it is more likely that people will continue to use the facilities badly, that is leaving it worse than it was or not using it at all. According to WHO (2008), clean facilities set a good example to users. Users are encouraged to leave the facility clean for the next user. Social acceptability is an important part of encouraging people to use toilets.

### 2.5.3. Hand Washing

It is widely reported and recognized that, to reduce the risk of cholera, infections, diarrheal and disease transmission, hand washing under a running tap with liquid soap at critical times, is one of the most important ways to prevent the spread of infections. Washing hands the right way at the right times can help reduce child morbidity rates from diarrheal diseases by almost 50 per cent (UNICEF, 2009). A latrine without a proper hand washing material will not serve its ultimate objective of disease prevention. Every latrine or toilet must have proper hand washing materials so that users can wash their hands after the use of toilet.

The first Global Hand washing Day launched on 15$^{th}$ October, 2008, was focus on schools and school children. This multi-partner global awareness raising initiative was celebrated in 85 countries; many countries used it as an opportunity to raise awareness and to launch yearround programmes in schools. Global Hand washing Day has now become an annual event (UNICEF, 2009).

## 2.6 Public Education on the Importance of Sanitation

It is very important to make sure that information about health and hygiene practices are available at public places. Such information should be displayed in an eye-catching, simple and accurate way, with the use of simple language. Where appropriate, large posters with bright colours and well-chosen messages, put up in obvious places, are effective. These messages should include the promotion of: hand washing, use of refuse bins, care of toilet facilities and protection of water supplies (WHO, 2008).

## 2.7 Ecological Sanitation

There is need for a paradigm shift away from the present conventional approach to a holistic approach, taking into account that sanitation is a system where the environment is a key element. To achieve the demand of ecological sanitation, we must have ecological toilets (Simpson-Hebert and Wood, 1998). This method acknowledges human excreta as more of a resource than waste and it is based on nutrient cycle approach. Excrement is treated in-situ and the formed end products are easily used as fertilizer in agriculture. Ecological sanitation techniques take into consideration the surrounding by decreasing contamination as well as keeping it clean and safe (Huuhtanen and Laukkanen, 2006). The primary aim of sanitation is to break the life cycle of pathogens and ecological sanitation approach help to achieve it. The use of the end product as fertilizer can help in resource preservation.

## 2.8 Candidiasis Infection

Vagina yeast infection also known as vagina Candidiasis or Volvo Vagina Candidiasis (VVC) is a common fungal infection of the genitals resulting to inflammation, irritation, itching and vagina discharge. A fungal is any of a group of unicellular, multicellular or syncytial spore – producing organisms feeding on organic matter, including molds, yeast, mushrooms and toadstools. It is any member of the group of eukaryotic organisms.

According to Lori (2015), vagina candidiasis infections are experienced by as many as 3 out of 4 women during their lifetime, with most women having the experience of at least two or more infections. Candidiasis infections are caused by the yeast species Candida Albicans. However, there are other species of Candida, which can cause an infection and may at times require different treatments. They include; Candida Albicans, Candida glabrata, Candida dubliniensis, Candida guilliermondii, Candida krusei, Candida lusitaniae, Candida parapsilosis, Candida tropicalis and Candida kefyr (Raju and Rajappa, 2011).

Balanced levels of yeast and bacteria are naturally present in a woman's vagina however disturbances in this harmonious balance often lead to the development of an infection. Naturally, the bacteria Lactobacillus produce an environment that is not conducive to yeast overgrowth. However, at times, yeast will become dominant thereby, causing symptoms of a yeast infection or when lactobacillus is involved using antibiotics.

Yeast infections of the vagina as reported by Lori (2015), are not sexually transmitted diseases; however, he added that it can be spread through oral-genital contact or during intercourse. He posited that there are certain risk factors that predispose a woman to a vagina yeast infection and include the following:

- Use of antibiotics and or corticosteroids
- Pregnancy
- Uncontrolled diabetes
- Being immune compromised
- Any scenarios that can cause changes in normal vagina flora including douching.

According to Lori (2015), frequent symptoms of candidiasis infection include:

- Vagina and vulvar itching or irritation
- Vagina burning, pain, soreness
- Vagina burning with intercourse or urination

- Vagina discharge resembling cottage cheese (thick and white) that is odourless.

Some women may experience a complicated candida yeast infection, which includes more severe symptoms and includes the presence of four or more infections in a single year. Complicated yeast infection symptoms include severe redness, swelling and itching, which often results in skin fissures or sores.

There are certain medical conditions reported to have caused complicated yeast infection and these include pregnancy, uncontrolled diabetes, being immune compromised and the presence of an alternate Candida fungus as opposed to Candida Albicans.

When diagnosing the presence of vagina yeast infection, health care provider will obtain a medical history, perform a pelvic exam to visualize the vulva, vagina and cervix for signs of infection and at times, a sample of vagina discharge will be tested.

A swab of vagina discharge may be evaluated under a microscope to determine if there is an abundance of yeast present. Once it is determined if there is the presence of an uncomplicated or complicated yeast infection, treatment will be recommended. Uncomplicated yeast infections can be treated with one of two methods - direct vagina therapy or oral treatment. When treating with short-course vagina therapy, varying methods of application may be recommended and range from a one-time treatment of a 1-7 day prescription or over-the-counter regimen by using medications such as butoconazole

(Gynazole-1), clotrimazole (Gyne-Lotrimin), miconazole (Monistat 3) and terconazole (Terazol 3), alternately, an oral antifungal, fluconazole (Diflucan), can be used in one single dose (Lori, 2015).

When yeast infections are classified as complicated, treatment will change and include the use of long-course vagina therapy or multi-dose oral formulations. At times, maintenance medications may be recommended. Long-course vagina therapy includes treatment with a

vagina cream, ointment, tablet or suppository for approximately 7-14 days. Alternately, two to three doses of oral fluconazole may be recommended instead of direct vagina therapy.

### 2.9 Candidiasis Infection from Toilet

Mensah (2015), in a study on the influence of toilet technologies on occurrence and exposure of females to shared toilet infections in Kumasi, Ghana, posited that Candidiasis was and is still widespread on campuses and it was as a result of toilets in bad conditions which are used by almost everybody in the institution. The study focused on females‟ hygienic practices and the link to the infection, toilet technologies in existence and the exposure of females to shared toilet infections.

Candidiasis is generally believed to be contracted from toilets that are not properly kept, especially from pit toilets. It can also be contracted from external sources, particularly in immune compromised individuals. It is more so as the fungal has been found to survive outside its host, on non-living or not animate surfaces for 24 hours to 120 days, as well as on other surfaces such as palms for about 45 minutes (Rangel-Fransto et al, 1994). Following the high survival rate of the fungus, candida Albicans has been isolated from bed-sheets, cots, and other inanimate surfaces, that a carrier has come in contract with. This is the more reason why it is possible for candidiasis to be easily transmitted or contracted by individuals with a weakened immune system or has been taking antibiotics or has a condition, such as diabetes that predispose the person to yeast infection

Candidiasis disease transmission can be avoided or prevented if ones immune system is healthy, and if only we can adopt and adhere to simple hygienic measures, such as hand washing and regular cleaning and disinfection of our sanitation toilets facilities. With these measures, one should be able to give a knockout punch to most of what we encounter in shared sanitation toilets today and put our germ-phobia to rest.

## CHAPTER 3: MATERIALS AND METHODS

### 3.1. Description of Study Area

Auchi community is made up of: Akpekpe, Igbe, Utsogun, Aibotse and Iyekhei. Auchi is the administrative headquarters of Etsako West local government of Edo State. Auchi is located 6$^{o}$ east of Greenwich and 7$^{o}$ north of the equator in the Edo State of Nigeria, (huts, 1976), with a population of 152,652 as of 2005/2006 population census. Auchi form a gate way to the states in the west and north of Nigeria. The soil is composed of sediments which rest on the underlying basement. There are sandy soils in most part of this area which are easily eroded and there are also loamy and silts soil in some parts. The topography is generally hilly, undulating and some valleys. It is situated in the northern part of Edo State and in the part of Nigeria termed as low land area, and is about 130 kilometres from Benin City the capital of Edo State. Figure 3.1 shows an overview map of the study area.

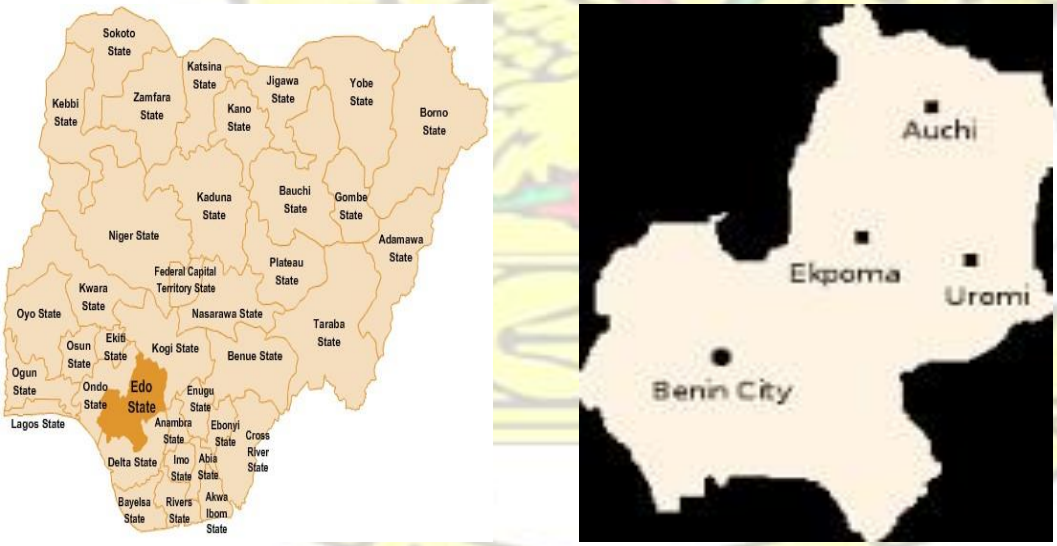



**Figure 3.1. An Overview Map of the Study Area.**

The nature of micro- climate of Auchi has adversely affected the vegetation of the land. Thus, the vegetation is that of the derived savannah with less dense trees and thick under growth

(Areola, 1982). The soil looks ferrulsols, which is mostly sandy-loamy apart from new Braimah estate Igarra road and upper Iyekhei where the soil is a bit compacted. The soil suffers from excess internal drainage and intense leaching. The structural stability and productivity of the soil is low as a result of the low forest vegetation.

Auchi lies within the tropical climate zone. It has an average annual rainfall of 800+1500mm. its leeward position at the feet of kukuruku hill ( Akoko- Edo hill )has greatly affected its local climate thus accounting for its low annual rainfall when compared to other towns, which lie along the same latitude ( oguntoyibo,1983 ). Temperature ranges between 70$^{o}$F (23$^{o}$C) and 95$^{o}$F (36$^{o}$C) during the dry hot harmattan period and an average daily temperature of 83$^{o}$F (28$^{o}$C) during the warm wet season.

The rainy season is usually between April and October with scanty amount of rainfall in November to March. The relative humidity of the atmosphere varies from 55% to 10%
(ministry of agriculture and natural resources). In Auchi, the tropical maritime air mass (south-west winds) brings rain from April to October while the north east wind brings hammattan and dry season from November to March. The southwest to northeast over the kukuruku hill while the tropical continental air mass (North East Winds ) is usually light hot, heavily laden with dust and sand blowing over the savannah grass land from the north to
Auchi and environs (Udo,1981)

### 3.2. Sampling

A reconnaissance survey of the study area was carried out. Firstly, to be acquainted with the female users of shared sanitation toilets, who are within 13 – 60 years old; of which the educational institutions were prominent where such facilities exist. Secondly, through the reconnaissance survey, the domestic shared sanitation toilets facilities were identified.

In addition to the administering of questionnaires and collection of high vagina swabs from volunteers, samples were collected from all educational institutions with shared sanitation toilets facilities. Samples were also collected from domestic shared sanitation toilet facilities which were randomly selected to represent the five quarters that made up the study area. The specific locations of these facilities (toilets) where sampling was taken for the study are found in Figures 3.2 – 3.4.

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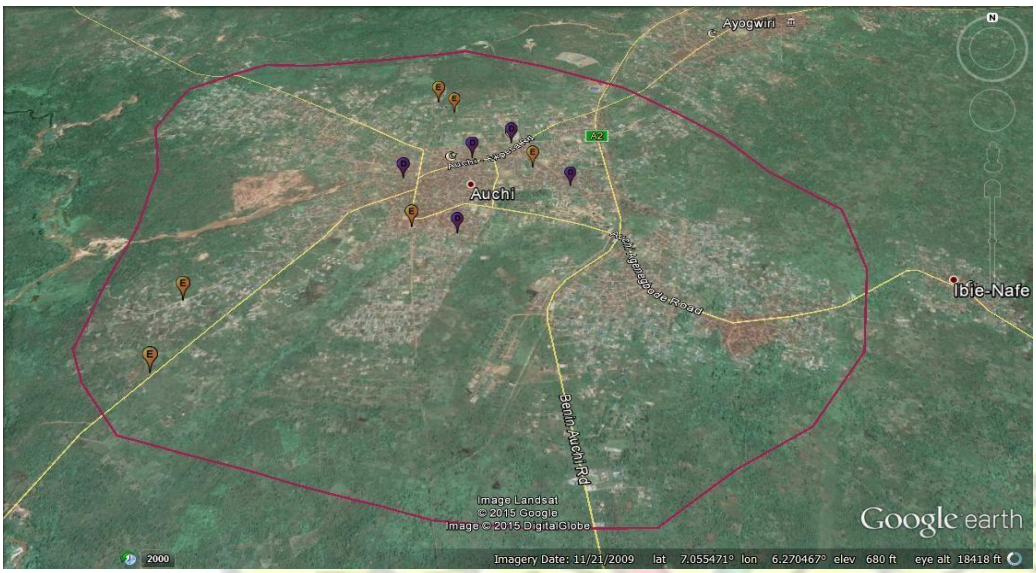



**Figure 3.2. Map of Auchi showing mapped areas of data collection**

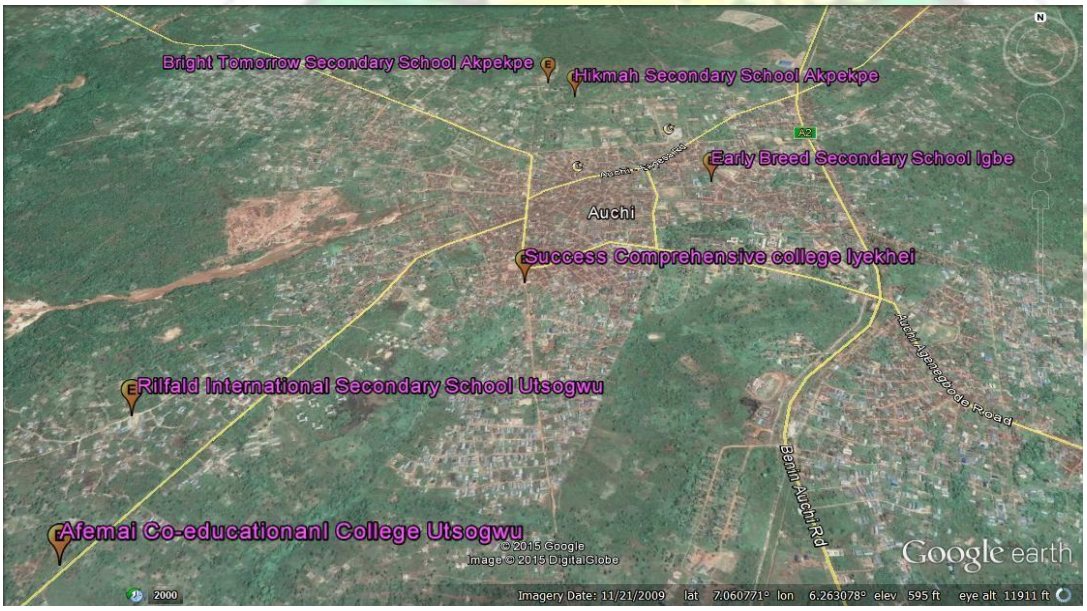


**Figure 3.3. Educational Facilities where data was collected**

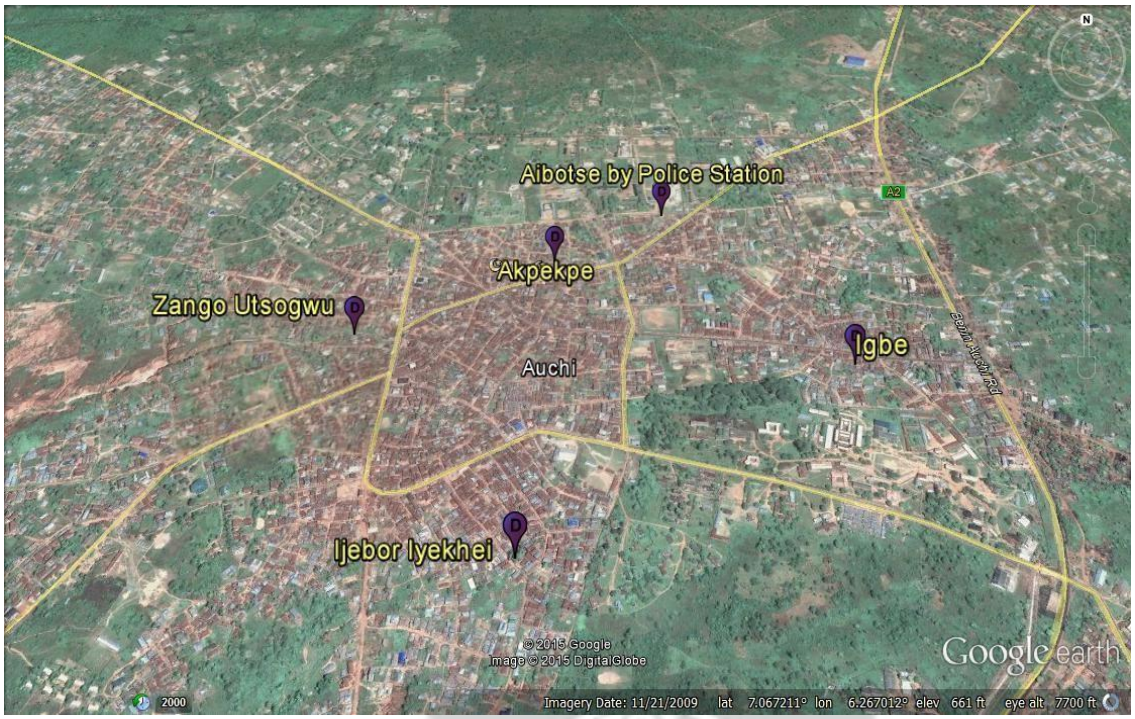



**Figure 3.4. Domestic Facilities where data was collected**

### 3.3. Sample Collection

Samples for laboratory analysis were collected from the vital areas of the shared sanitation toilets facilities (i.e. seats, walls, floors and door handles) and from volunteers for high vagina swabs (HVS). Sterile cotton wool on plastic sticks (sterile swab stick) used for the collection of samples was purchased from a pharmaceutical store in Auchi. The swab was swiped or rubbed on the targeted surfaces and immediately placed back to its air tight tube and were sent to the laboratory.

A total of sixty-six samples were collected, this is made up of 24 samples from 6 educational shared sanitation facilities, 20 samples from 5 domestic shared sanitation facilities and 22 high vagina swabs (HVS). A summary of the samples labelling is shown in Table. 3.1.

**Table 3.1. A summary of the samples labelling**

| | |
|---|---|
| Locations 01A, 01B, 01C, 02A, 02B, 02C, 03A, 03C, 04A, 04C, and 05C<br>Targeted surface T(I), T(W), T(F), T(H) and HVS sampled<br>Label Code [Location]{Targeted Surface}(S/No; if more than one) | |
| Location | Sample Label |
| Utsogun<br>Institutions –<br><br><br><br>Domestic –<br><br>HVS - | 01AT(I), 01AT(W), 01AT(F), 01AT(H)<br>01BT(I), 01BT(W), 01BT(F), 01BT(H)<br>01CT(I), 01CT(W), 01CT(F), 01CT(H)<br>01HVS(1), 01HVS(2), 01HVS(3), 01HVS(4)<br>01HVS(5), 01HVS(6), |
| Akpekpe<br>Institutions –<br><br><br><br>Domestic –<br><br>HVS - | 02AT(I), 02AT(W), 02AT(F), 02AT(H)<br>02BT(I), 02BT(W), 02BT(F), 02BT(H)<br>02CT(I), 02CT(W), 02CT(F), 02CT(H)<br>02HVS(1), 02HVS(2), 02HVS(3), 02HVS(4) 02HVS(5),<br>02HVS(6), |
| Igbe<br>Institution –<br><br>Domestic –<br><br>HVS - | 03AT(I), 03AT(W), 03AT(F), 03AT(H)<br>03CT(I), 03CT(W), 03CT(F), 03CT(H)<br>03HVS(1), 03HVS(2), 03HVS(3), 03HVS(4) 03HVS(5), |
| Iyekhei<br>Institution –<br><br>Domestic –<br><br>HVS - | 04AT(I), 04AT(W), 04AT(F), 04AT(H)<br>04CT(I), 04CT(W), 04CT(F), 04CT(H)<br>04HVS(1), 04HVS(2), 04HVS(3), 04HVS(4) |
| Aibotse<br>Domestic –<br><br>HVS - | 05CT(I), 05CT(W), 05CT(F), 05CT(H) 05HVS(1) |

*KEY*

Location 01A- Afemai Co-educational College (Utsognn)

" 01B–Rilfald International College (Utsogun)

" 01C – Shared Domestic Facility (Utsogun)

" 02A- Brighter Tomorrow College (Akpekpe)

" 02B–HikmahSecondary School (Akpekpe)

" 02C – Shared Domestic Facility (Akpekpe)

" 03A - Early Breed Secondary School (Igbe)

" 03C – Shared Domestic Facility (Igbe)

" 04A–Success Comprehensive College (Iyekhei)

" 04C – Shared Domestic Facility (Iyekhei)

" 05C – Shared Domestic Facility (Aibotse)

T (I) ---Toilet Inside

T (W) ---Toilet walls

T (F) ---Toilet Floors

T (H) ---Toilet Handles

3.3.1 Administration of Questionnaire Procedure

A total of 550 structured questionnaires were randomly administered to female in educational and domestic facilities in Auchi community. Only 445 questionnaires were returned out of which 421 were found to be correctly filled. The returned sample of 421 was subjected to sampling size determination procedure known as Taro Yamane (1961) in Shaib and Umar (2012).

The sample size is determined from:

$n = N/ [1+N (e)^2]$ (3.1)

Where N is the number of questionnaire returned e is the level of precision (5%) n is the sample size $n = 421/ [1+421 (0.05)^2]$ $n = 421/ \{1+421 (0.0025)\}$ $n = 421/ \{1+1.0525\}$ n =421/2.0525 n = 205

Two hundred and five questionnaires from the female respondents were used for the empirical analysis with the help of statistical package for social sciences (SPSS) version 16.0 (see appendix C1 and C2) for data, coding and SPSS window.

### 3.4 Identification of Candida

The laboratory isolation, enumeration and identification of candida in the samples of the shared sanitation toilets and HVS were done using the following procedures:

#### 3.4.1 Preparation of Nutrient Agar Solution

Fourteen grams of Nutrient Agar was dissolve in 500 millilitres of distilled water, in a flat bottom flask and covered with a cotton wool. The mixture is allowed to stand in an autoclave for about 15 minutes for proper sterilization. 25 millilitres of the sterilized hot solution is put in each petri dish on a flat surface and allowed to set for about 1 hour 30 minutes to 2 hours. This is called plating. Plating is to allow free organism environment before inoculation.



**Figure 3.5. Plating Process.**

#### 3.4.2. Inoculation

After plating, inoculation or streaking takes place by applying the swab samples on the prepared Petri dishes in a zigzag manner or pattern or in circular manner or pattern and tagged before

incubating it at 37ºC. Incubated samples were checked for growth at 24 hoursand at 48 hours respectively.



**Figure 3.6. Sample Specimen after Culture.**

3.4.3. Wet Preparation

2 millilitres of saline solution was added to high vagina swab (HVS) sample in its air tight tube and allowed to stand for 30 minutes. Shake the tube and apply a drop on a slide. The slide is covered with a slip and viewed under a microscope of x10 magnification.

The following are the expectations of the microscopic observations:

(i) Pus cells: They are circular in shape having a rough and greyish cytoplasm with no definite nuclei. The cells are larger than red blood cells.

(ii). Red blood cells: These are circular in shape having a clear cytoplasm with a centrally located nucleus or nuclei, the red cells are smaller than the pus cells.

(iii). Epithelia cells: These are leaf like; they are larger than red blood cells and pus cells.

(iv). Monilia (Yeast cells): They are yeast cells, they undergo budding, and they are like a chain of pus cells.

(v). Trichomonas vaginalis: This is a protozoan find in the high vagina swab having a circular shape that moves in a random manner.

3.4.4. Gram stain

The high vagina swab (HVS) sample is applied in a circular manner on a slide over a burning flame. Allow the sample to dry on the slide over the flame. Crystal violet is added to the slide on the staining rake for a minute, then rinse with distilled water. The slide is then mordant with acid alcohol and allowed to stand for 30 seconds and rinse again with distilled water. Safranine is added for a minute, rinse with distilled water and allows dry.

The slide is viewed under an oil immersion objective of a compound microscope. .Gram positive organisms retain the colour of crystal violet which is the primary stain. This is because the gram positive organisms have a thick coat. Gram negative organism retains the colour of the secondary stain (safranine). This is because the gram negative organisms do not have a thick coat.

### 3.5. Hygienic Conditions of the Shared Sanitation Toilets

The shared sanitation toilets facilities were physically examined for their hygienic conditions. Careful observations were made on the squat holes or toilets seats, floors and walls of the toilets supper structure and cistern or door handles and locks. Figure 3.7 shows some of the shared sanitation facilities inspected.



a. b.

c. d.

e. f.

**Figure 3.7. Some of the Shared Sanitation Facilities Inspected**

(a). Igbe (b).Utsogun (c). Akpekpe (d), (e).Aibotse (f). Iyekhei

## CHAPTER 4: RESULTS AND DISCUSSION

### 4.1 Introduction

The results of the research and the preceding discussion are presented in the light of the research objectives. These results are treated analytically in the light of findings of related research work and with the help of some basic inferential statistics. This yields a number of significant observations as presented in preceding sections.

## 4.2. Presence of Candida Albicans in Toilets and High Vagina Swab Samples

4.2.1 Toilet Swab Samples

Tables 4.1 and 4.2 show results of the laboratory investigation for the assessment of the presence of Candida Albicans in shared sanitation toilet facilities, cultured at $37^0$c for 24 hours and 48 hours respectively. From the twenty four (24) samples from 6 toilets analysed from educational institutions shared sanitation toilets facilities, Candida Albicans were present in the toilet of only one sanitation facility (Hikmah Secondary School, Akpekpe). There was no trace of Candida on the walls, floors and handles of these facilities. Analysis of the twenty samples collected from 5 domestic shared sanitation toilets facilities shows the presence of Candida Albicans in the toilets of Akpekpe and Aibotse. Candida Albicans was also present on the wall of Aibotse domestic shared sanitation toilet facilities.

**Table 4.1. Presence of Candida and type of Toilet (toilet swab) in Educational Institutions.**

| Location | No of Samples | Results | Number of toilets | Type of toilet | Sitting or squatting |
|---|---|---|---|---|---|
| 01A(Utsogun) | 4 | Negative | 1 | Pour flush | Squatting |
| 01B (Utsogun) | 4 | Negative | 1 | Pit latrine | Squatting |
| 02A ( Akpekpe ) | 4 | Negative | 1 | Pour flush | Squatting |
| 02B (Akpekpe) | 4 | Positive | 1 | Pour flush | Squatting |
| 03A (Igbe) | 4 | Negative | 1 | Ventilated improved latrine (VIP) | Squatting |

| | | | | | |
|---|---|---|---|---|---|
| 04A (Iyekhei) | 4 | Negative | 1 | Ventilated improved pit latrine (VIP) | Squatting |

**Table 4.2. Presence of Candida and type of Toilet (toilet swab) in Domestic**

| **Location** | **No of Samples** | **Results** | **Number of toilets** | **Type of toilet** | **Sitting or squatting** |
|---|---|---|---|---|---|
| 01C (Utsogun) | 4 | Negative | 1 | Pit latrine | Squatting |
| 02C (Akpekpe) | 4 | Positive | 1 | Pit latrine | Squatting |
| 03C (Igbe) | 4 | Negative | 1 | Pit latrine | Squatting |
| 04C (Iyekhei) | 4 | Negative | 1 | Ventilated improved pit latrine (VIP) | Squatting |
| 05C (Aibotse) | 4 | Positive | 1 | Pit latrine | Squatting |

4.2.2 High Vagina Swab Samples

Presented in Appendix B4 are laboratory analysis results of the high vagina swab samples. Only respondents that affirm that they have or have had the symptom(s) of toilet infection were asked to volunteer high vagina swab for further laboratory investigation, out of the Eighty five (85) respondents (41.5%) in this category 22 volunteer high vagina swab while 63 decline, as shown in table 4.3. Table 4.4 shows the summary of the high vagina swab test result. Out of the 22 high vagina swab volunteer, 5 prove positive; they were found to be infected with Candidiasis, while the remaining 17 were negative; they were no longer infected with yeast infection (Candidiasis).

**Table 4.3. Volunteer high vagina swab (HVS) for Laboratory investigation**

| Parameters | Frequency | Percent |
|---|---|---|
| Do not have the infection | 120 | 58.5 |
| Volunteer to give HVS, had infection | 22 | 10.7 |
| Decline to give HVS, had infection | 63 | 30.7 |
| Total | 205 | 100.0 |

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**Table 4.4. High Vagina Swab Test Result**

| Results | Frequency | Percent |
|---|---|---|
| Not applicable | 183 | 89.3 |
| Positive | 5 | 2.4 |
| Negative | 17 | 8.3 |
| Total | 205 | 100.0 |

Table 4.5 show the summary of the investigation results of the high vagina swab samples viza-viz the location of the toilets in the community, the type of toilet and the usage position of the respondents.

**Table 4.5.High Vagina Swab (HVS), location and type of Toilet**

| Location/Sample Label | Positive or Negative | Type of toilet | Sitting or squatting |
|---|---|---|---|
| 01 (Utsogun) | | | |
| 01HVS(1) | Negative | Pit latrine | Squatting |
| 01HVS(2) | Negative | Pit latrine | Squatting |
| 01HVS(3) | Negative | Pit latrine | Squatting |
| 01HVS(4) | Positive with oil droplet | Pit latrine | Squatting |
| 01HVS(5) | Positive | Pit latrine | Squatting |

| | | | |
|---|---|---|---|
| 01HVS(6) | Negative | Pit latrine | Squatting |
| 02 (Akpekpe) | | | |
| 02HVS(1) | Negative | Pour flush | Squatting |
| 02HVS(2) | Negative | Pour flush | Squatting |
| 02HVS(3) | Negative | Pour flush | Squatting |
| 02HVS(4) | Negative | Pour flush | Squatting |
| 02HVS(5) | Negative | Pour flush | Squatting |
| 02HVS(6) | Negative | Pour flush | Squatting |
| 03(Igbe) | | | |
| 03HVS(1) | Positive | Pit latrine | Squatting |
| 04(Iyekhei) | | | |
| 04HVS(1) | Positive | Ventilated improved pit latrine | Squatting |
| 04HVS(2) | Negative | Ventilated improved pit latrine | Squatting |
| 04HVS(3) | Negative | Ventilated improved pit latrine | Squatting |
| 04HVS(4) | Negative | Ventilated improved pit latrine | Squatting |
| 04HVS(5) | Negative | Ventilated improved pit | Squatting |
| | | latrine | |
| 05(Aibotse) | | | |
| 05HVS(1) | Positive | Pit latrine | Squatting |
| 05HVS(2) | Negative | Pit latrine | Squatting |
| 05HVS(3) | Negative | Pit latrine | Squatting |
| 05HVS(4) | Negative | Pit latrine | Squatting |

4.2.3 Presence of Candida Albicans Infection among Females

Results of the investigation show that 85 (41.5%) of the respondents have or have had the incidence of Candida Albicans. Whereas, 120 (58.5%) of the respondents indicated that they

have never had any symptoms of candidiasis. A cross tabulation of those who volunteered high vagina swab and the facility investigated presented in table 4.6 shows that of the 22 respondents who volunteered high vagina swab, the proportion of the respondents in educational or domestic facilities are 9 and 13 respondents respectively.

**Table 4.6. Volunteered high vagina swab (HVS) for Laboratory investigation Facility Investigated Cross tabulation**

| **Results** | | Facility Investigated | | |
|---|---|---|---|---|
| | | Educational | Domestic | Total |
| Volunteer high vagina swab (HVS) for Laboratory investigation? | Not applicable | 44 | 76 | 120 |
| | Yes | 9 | 13 | 22 |
| | No | 23 | 40 | 63 |
| Total | | 76 | 129 | 205 |

Table 4.7 shows the results of the high vagina swab and the proportions of the respondents from educational or domestic facilities. Out of the 5 respondents that prove positive; they were found to be infected with Candidiasis, 1 was from educational facility, while 4 where from domestic facility.

**Table 4.7. High Vagina Swab Test Result * Facility Investigated Cross tabulation**

| **Results** | | Facility Investigated | | |
|---|---|---|---|---|
| | | Educational | Domestic | Total |
| High Vagina Swab Test Result | Not applicable | 67 | 116 | 183 |
| | Positive | 1 | 4 | 5 |
| | Negative | 8 | 9 | 17 |
| Total | | 76 | 129 | 205 |

Virtually all respondents alluded to the fact that the infection was contracted from one toilet or the other, that they had used. Most of the sanitation toilet facilities investigated, either in educational or domestic are no doubt in a very bad state of disuse and unhealthy conditions that can be a source of serious health problem within and around the study area.

Investigation results of shared sanitation toilets shown in table 4.8 revealed the presence of candida Albicans in the sanitation toilets of one educational facility and the toilet type was pour flush and two domestic facility whose toilet are both pit latrine. The investigation also revealed that the type of toilet been used by those whose high vagina swab test result proved positive were basically pit latrine and ventilated improved pit latrine.

**Table 4.8. Presence of Candida Albicans Toilet**

| **Facility** | **Location** | **Sample Label** | **Type of Toilet** |
|---|---|---|---|
| Educational | Akpekpe | 02B | Pure Flush |
| Domestic | Akpekpe | 02C | Pit Latrine |
| Domestic | Aibotse | 05C | Pit Latrine |
| Domestic | Utsogun | 01HVS(4) | Pit Latrine |
| Domestic | Utsogun | 01HVS(5) | Pit Latrine |
| Domestic | Igbe | 03HVS(1) | Pit Latrine |
| Educational | Iyekhei | 04HVS(1) | VIP Latrine |
| Domestic | Aibotse | 05HVS(1) | Pit Latrine |

Figure 4.1 shows the association between high vagina swabs and toilet infections, it is obvious that only the respondent from Aibotse domestic [05HVS (1)] can be linked with shared sanitation toilet that is also candida Albicans infected. Other HVS positive respondents must have been infected from other sources as the toilets they currently use are candida Albicans negative. Its worthy of note that no HVS respondents from Akpekpe educational and domestic facilities can be linked to the shared sanitation toilets that were candida Albicans positive. These respondents must have since their earlier encounter with candida Albicans infection are now more careful with the use of the facilities and more also observing good hygiene and sanitation practices.

| | **Particulars of Positive HVS** | | **Toilet in Use** |
|---|---|---|---|

| | | | |
|---|---|---|---|
| 1. | 01HVS(4) Positive Utsogun Domestic | → | Toilet Negative [01C- Utsogun] Pit Latrine |
| 2. | 01HVS(5) Positive Utsogun Domestic | → | Toilet Negative [01C- Utsogun] Pit Latrine |
| 3. | 02HVS (0) Negative Akpekpe Educational | → | Toilet Positive [02B- Akpekpe] Pour Flush |
| 4. | 02HVS (0) Negative Akpekpe Domestic | → | Toilet Positive [02C- Akpekpe] Pit Latrine |
| 5. | 03HVS(1) Positive Igbe Domestic | → | Toilet Negative [03C- Igbe] Pit Latrine |
| 6. | 04HVS(1) Positive Iyekhei Educational | → | Toilet Negative [04A- Iyekhei] VIP Latrine |
| 7. | 05HVS(1) Positive Aibotse Domestic | ↔ | Toilet Positive [05C- Aibotse] Pit Latrine |

**Figure 4.1. Association between High Vagina Swab (HVS) and Toilet Infections**

### 4.3. Hygienic Conditions of Shared Sanitation Toilets

4.3.1 Classes and Types of Toilet

In order to assess the classes and types of toilet, rate of usage, frequency of cleaning and the hygienic conditions of shared sanitation toilets, a field survey was carried out. The frequency analysis result of the class and type of toilet use in school and domestic are illustrated in figures 4.2 – 4.4. The analysis of the class of toilets revealed that single household latrine is mostly used by the respondents, which is 96 representing 46.8%. 72 respondents used shared

household latrine representing 35.1% and 37 uses shared neighbourhood latrine representing 18%. Its worthy of note that shared public latrine is not visible in the study area; the parcel of land that housed a shared public latrine in the 1980‟s, today houses a popular eatery in the heart of the town.

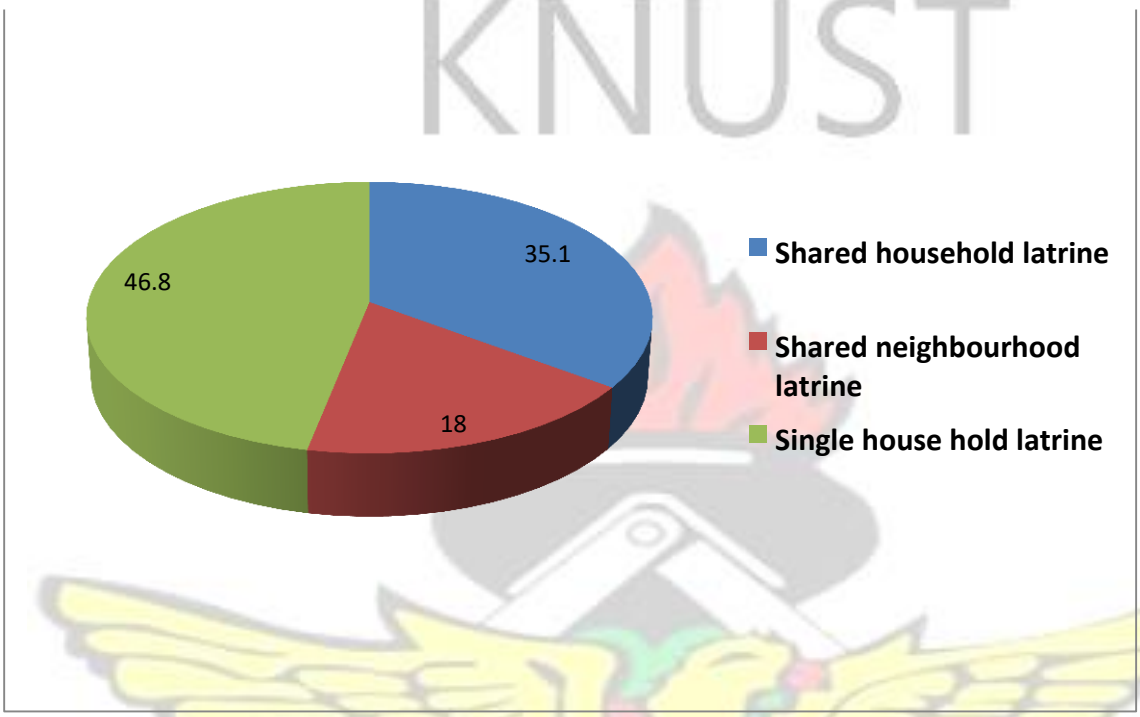



**Figure 4.2. Percentage of Respondents by Class of Toilet used at Home**

On the type of toilets, the water closet stands out, as been mostly used at home. One hundred and twenty-three (123) representing 60% respondents use water closet at home as against 4 respondents representing 2% that use water closet in school, this is followed by pour flush latrine with 33 respondents, representing 16.1% for the home, and 39 representing 19% at school. Again, 33 respondents representing 16.1% uses pit latrine at home as against 13 representing 6.3% for school. 10 (4.9%) respondents‟ uses ventilated improved pit latrine at home which was 6 (2.9%) in school. Six (6) respondents representing 2.9% use open field for their convenience at home as against a whopping 21 respondents representing 10.2% that use open field defecation while in school.

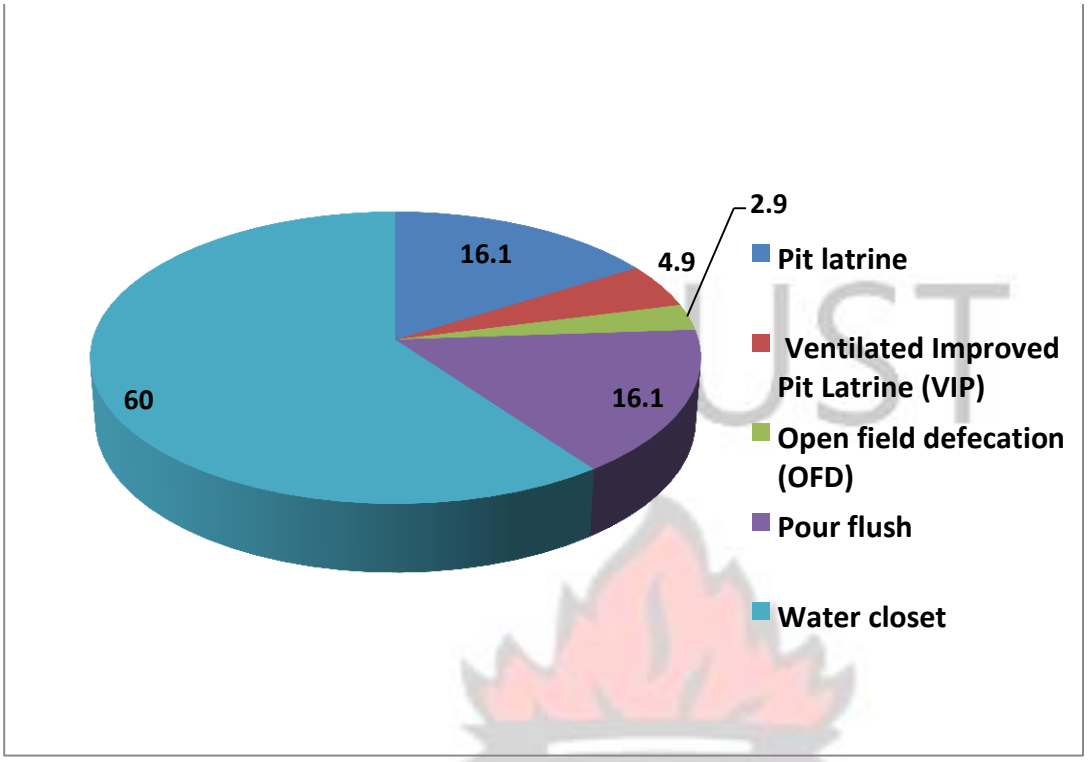



**Figure 4.3. Percentage of Respondents by Types of Toilet used at Home**

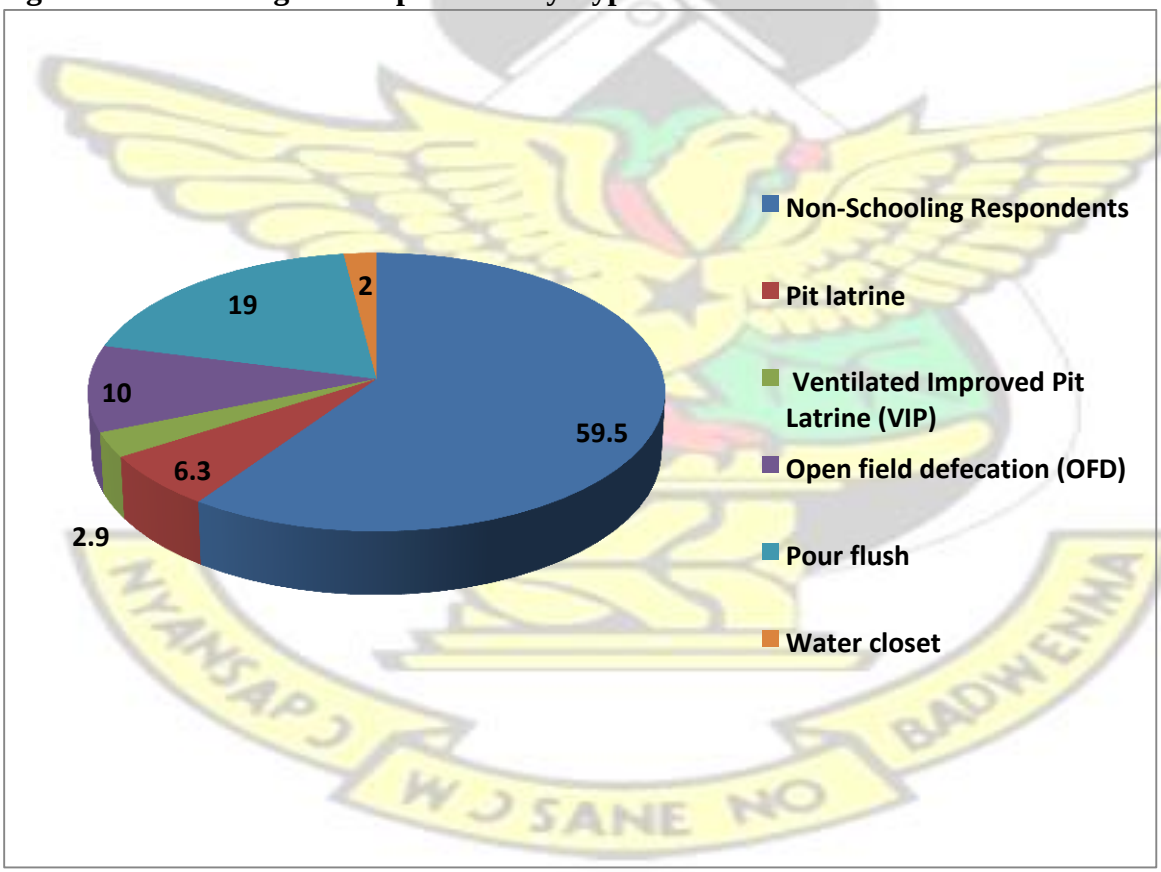



**Figure 4.4. Percentages of Type of toilet used at school**

Cross tabulation analysis of type of toilet used at home and its class shown in figure 4.5 reveals that out of 33 females that used pit latrine, 13 are shared household latrine (39.4%); 12 shared

neighbourhood latrine (36.4%) and 8 single house hold latrine (24.2%) . Ventilated improved pit latrine results indicate that of 10 females respondents, 8 shared household latrine (80.0%) and 2 shared neighbour hold latrine (20%). Responses on open field defecation shows that 2 out of 6 females shared household latrine represents (33.3%) and 4 shared neighbour hold latrine (66.7%). This result indicated an illogical finding as no open field defecation practices involves class of toilet. The respondent may have filled the opinion without clarity. Of the 33 respondents on pour flush type of toilet, 16 used shared house hold latrine class representing 48.5% ; 12(36.4%) shared neighbour hold latrine and 5(15.2%) single house hold latrine. Water closet type of latrine responses show that out of 123, 33 shared house hold latrine (26.8%) ; 7(5.7%) shared neighbour hold latrine and 83 single house hold latrine which make up 67.5%. Suffice is to say that the main type of latrine used by the females in Auchi community is water closet the class of toilet is single house hold latrine representing 60.0% and 46.8% respectively.

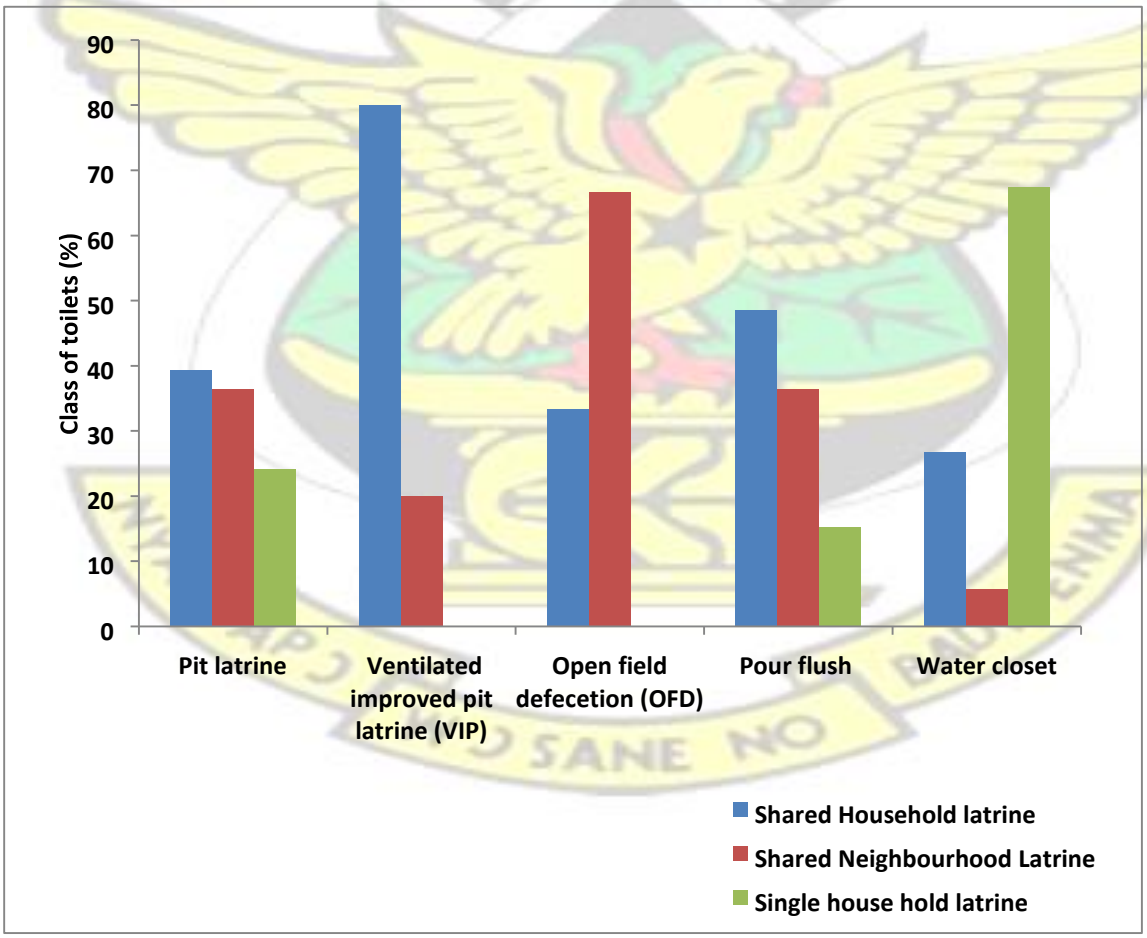


**Figure 4.5. Cross tabulation of type of toilet used at home and class of toilet**

4.3.2 Rate of Toilet Usage

In figure 4.6 below, the frequency analysis result of rate of toilet usage in school reveal that 136 females regularly use toilet represent 66.3%; 43 seldom used toilet represent 21.0% and 26 female never use toilet represent 12.7%. The investigation also revealed that majority of the respondents regularly uses the toilets at home. Hence, female using toilets regularly at home and at school are because of their nature, attitude and way of convenience.

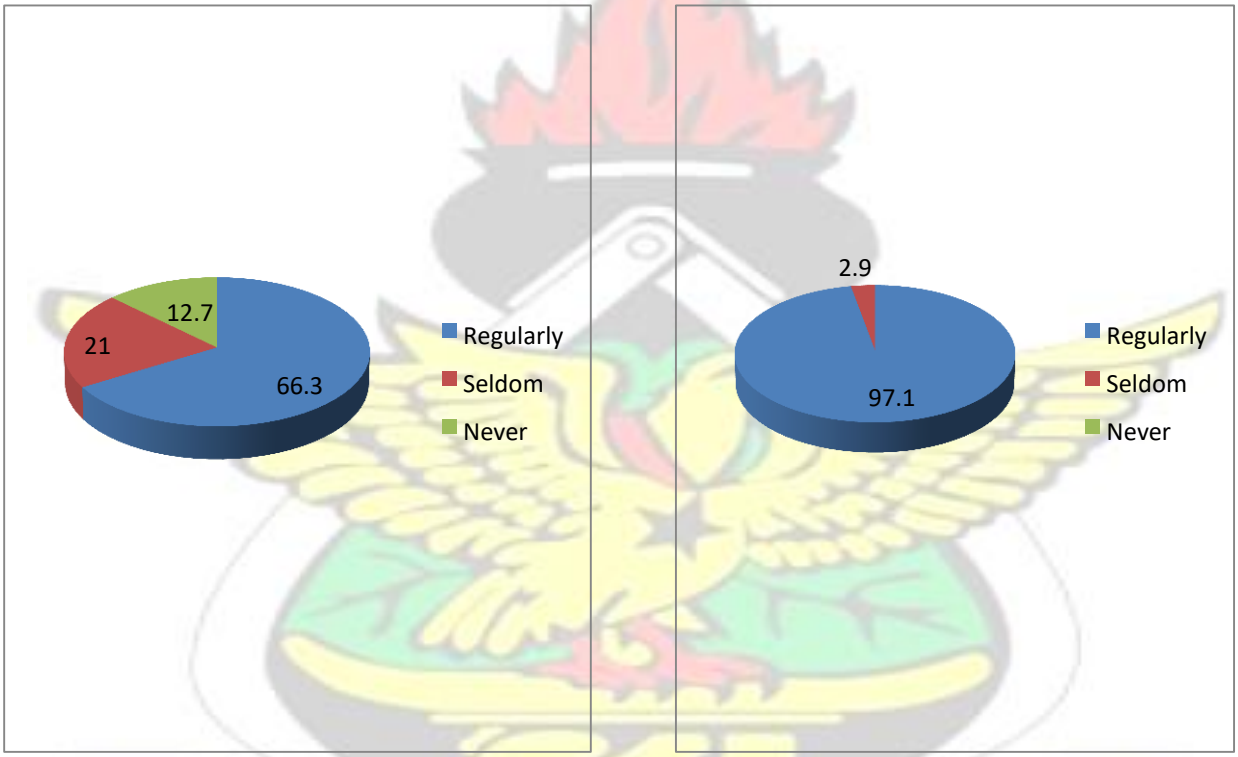



**Figure 4.6. Frequency of usage of school or house toilet facilities**

4.3.3 Frequency of Cleaning and hygienic conditions

Investigating the level of cleaning latrine/toilet statistics presented in figure 4.7 shows that 80 female believed the daily cleaning of latrine facility represent 39.0% ; 70 (34.1%) weekly ; 24 (11.7%) two or three times a week, 11 (5.4%) monthly ; 14 (6.8%) not sure and 6 (2.9%) not applicable to cleaning of toilets. The prominent among the latrine frequency facility cleaning, the finding shows that female often cleaned the toilet facility daily and weekly.

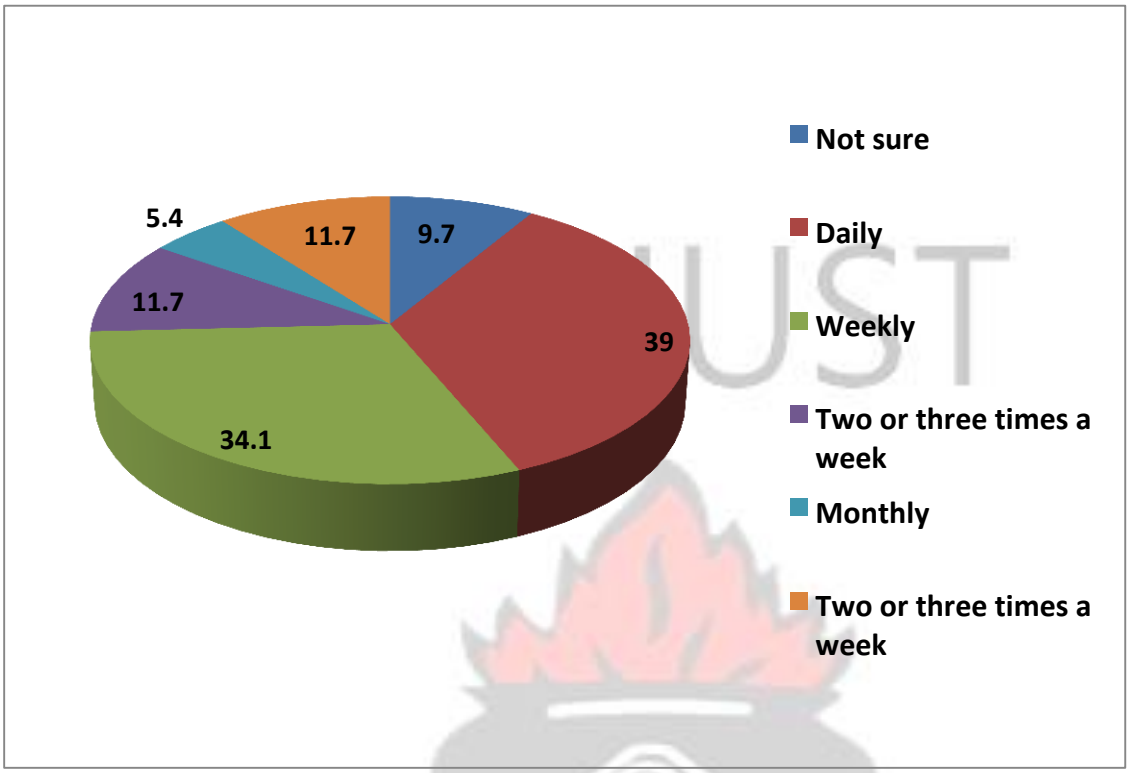



**Figure 4.7. Frequency of cleaning of toilet facilities**

The results of the careful observations made on the squat holes, floors and walls of the toilets supper structure and cistern or door handles and locks of the shared sanitation facilities are presented in Appendix B5 and B6. Most of the facilities investigated, either in educational or domestic are in a very bad state. Following the state of disuse and unhealthy condition of most shared sanitation toilets within the study area, they can be a source of serious health problem within and around Auchi community.

### 4.4. Candidiasis Infection among Females

Several factors have been alluded to contribute to candidiasis infection among females. Some of the survey questions seek to answer questions such as; respondents awareness of millennium development goals to halve the people living without basic sanitation by 2015, contacting vagina infection from the use of toilet, individual hygiene practices and habits.

On awareness of the millennium Development goals (MDGs) to halve the people living without basic sanitation by 2015, table 4.9, the descriptive statistic result of the respondents showed that 39

are aware of the goal, representing 19%. However, 116 of the respondents (females) representing 81% are not aware of the MDGs to halve people living without basic sanitation by 2015. From table 4.10, majority of the respondents have the awareness that vagina infection could be contacted from the toilet, 201 respondents representing 98%. In general, most of the females in the study are not in tune with the MDGs to halve the number of people living without basic sanitation by the year 2015. This could also contribute to the prevalence of toilet infection in Auchi community.

**Table 4.9. MDGs Awareness to halve the people living without basic sanitation by 2015.**

| Response | Frequency | Percent |
|---|---|---|
| Yes | 39 | 19.0 |
| No | 166 | 81.0 |
| Total | 205 | 100.0 |

**Table 4.10. Awareness of contacting infection from toilets.**

| Response | Frequency | Percent |
|---|---|---|
| Yes | 201 | 98.0 |
| No | 4 | 2.0 |
| Total | 205 | 100.0 |

Figure 4.8 showed the result of respondents various positions while using the toilet. The result revealed that out of 205 respondents, 78 believed in sitting when using the toilet which is 38%. 119 respondents believed in squatting position with 58% and 8 respondents believed in standing position with 3.9%. On the whole, there is a general opinion that squatting position is usually adopted during the use of toilet both at school and domestic facilities.

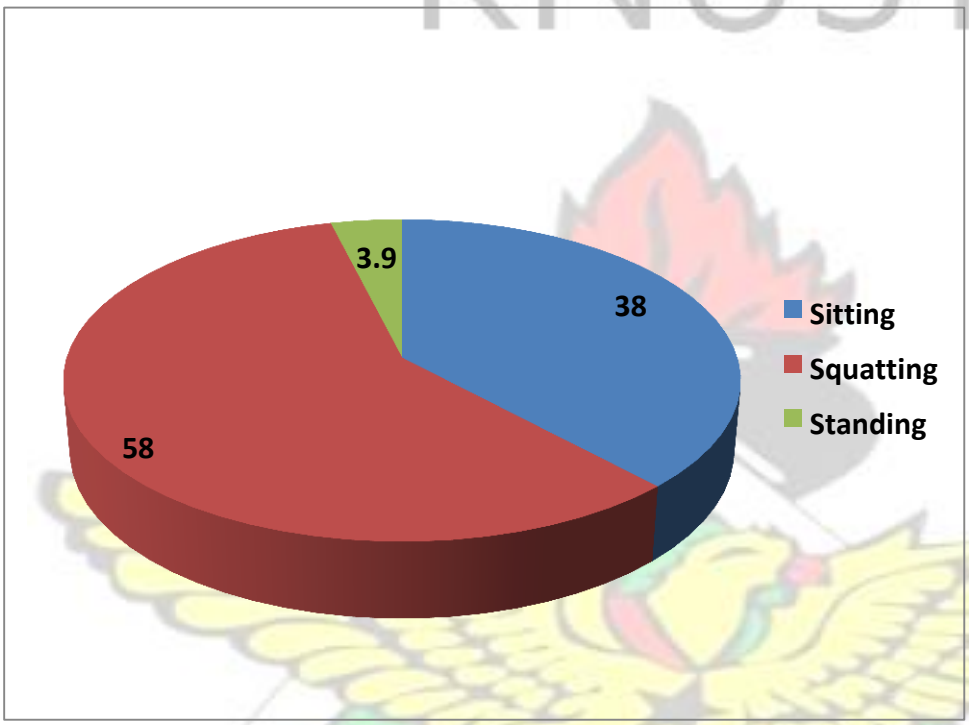



**Figure 4.8. Percentage of users in various toilet positions**

In terms of reasons for choosing the various positions while using the latrine both at school and home, the frequency analysis results shown in table 4.11indicates that 157 out of 205 respondents said that is how the latrine should be used representing 76.6%; 44(21.5%) said it is to avoid infection and 4(2.0%) believed that the latrine is dirty. The result suggested that the choice of selecting among various positions during the use of the toilet using the toilet in accordance to how the toilet should be used stands out. This is followed by the avoidance of infection. Therefore, the finding confirmed that the usage position of latrine might contribute to the frequency of latrine infection (disease) menace among females in Auchi community.

**Table 4.11. Reasons for Choosing the Various Positions while Using the Latrine**

| Response | Frequency | Percent |
|---|---|---|
| That is how the toilet should be used | 157 | 76.6 |
| To avoid infection | 44 | 21.5 |
| The toilet is dirty | 4 | 2.0 |
| Total | 205 | 100.0 |

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Cross tabulation analysis of type of toilet used at home and source of water supply shown in figure 4.9 reveals that out of 33 females that used pit latrine, 13 rely on bore hole (39.4%); 9 used hand dug well (27.3%) and 11 rely on water vendors (33.23%) .

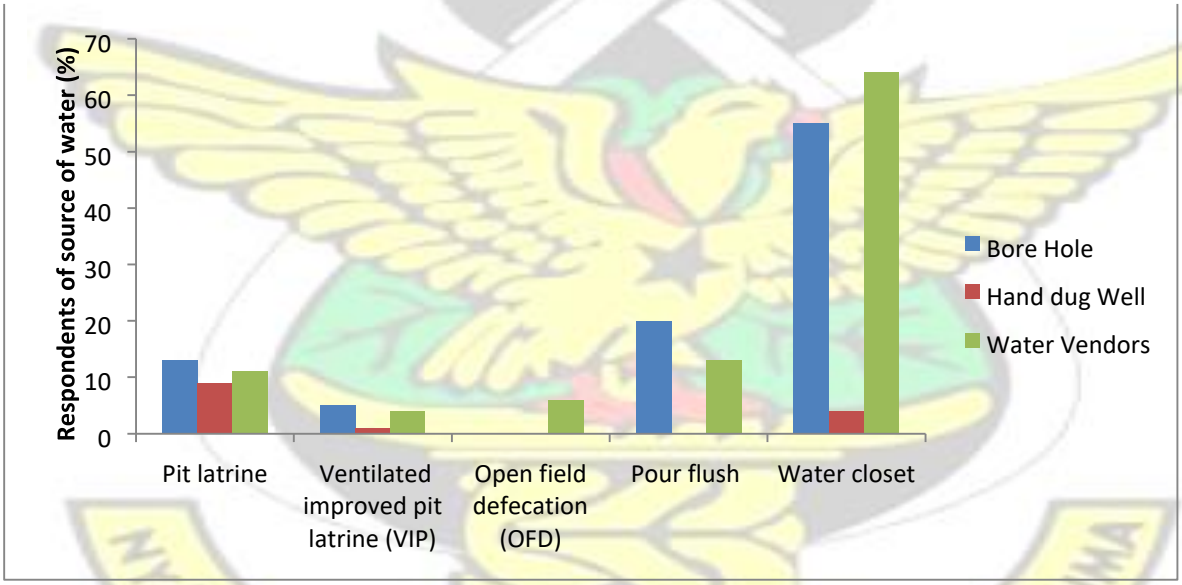



**Figure 4.9. Cross tabulation analysis of type of toilet used at home and source of water supply**

Ventilated improved pit latrine results indicate that out of 10 female respondents, 5 use bore hole (50.0%), 1 use hand dug well (10%) and 4 buy water from water vendors (40%). Responses on open field defecation show that the 6 females rely on water vendors (100%). Of the 33 respondents on pour flush type of toilet, 20 used bore hole representing 66.6% ;

12(36.4%) and 13(39.4%)buy water from water vendors. Water closet type of latrine responses show that out of 123, 55used bore hole (44.7%) ; 4(3.3%) used hand dug well and 64 representing 52.0% buy water from water vendors.

### 4.5. Effect of Candidiasis Infection on Toilet Users

In the field survey analysis to assess the effect of infection on the work and daily life of those infected presented in Appendix C5, the result shows that 85 agreed to have had vagina infection, out of which 22 volunteer swabs for further laboratory investigation making 25.9%. The survey suggested that 3 said that the infection had no serious effect, while 19 agreed that the infection caused them discomfort and loss of valuable man hours during their work and daily life. The sixty three of the eighty five respondent who agreed to have had the infection but decline to volunteer high vagina swab; indicated that 41 (48.3%) said it caused discomfort and loss of valuable man hours. Nineteen (19) said it had no serious effect and 3 said the infection is not applicable (disturb) to their work and daily life. In general, high virginal swab (HVS) test results confirmed that infection causes discomfort and loss of valuable man hours in work and daily life of those infected by candidiasis.

## CHAPTER 5: CONCLUSIONS AND RECOMMENDATIONS

### 5.1. Conclusions

From the analysis of the results of this investigation, the following conclusions can be deduced.

(i). Candida Albicans has been found to be present in some sheared sanitation toilets of both educational and domestic facilities in Auchi community. This collaborate Haines et al., 2000 reasons why people are reluctant to use shared sanitation toilets because of the poor sanitary conditions and fear of toilet infections.

(ii). There is a general perception among females that candidiasis is gotten from toilets. Most females are highly reluctant to talk about the infection even when they are victims. This is

evident from the eighty five respondents that affirm that they have or have had the symptom(s) of toilet infection only twenty two volunteer high vagina swabs for further laboratory investigation and 5 were positive; they were found to be infected with Candidiasis.

(iii).Virtually all respondents are conscious of the fact that toilet infection can be contracted from toilets that are in bad shape. On the contrary, they are ill informed of the developmental goal to halve, by 2015, the proportion of people without sustainable access to safe drinkingwater and basic sanitation. In effect there is no conscious effort to achieving the millennium development goal number seven, goal target number ten in the study area.

(iv). National Water Supply and Sanitation Policy (2000) emphasizes – in accordance with the Millennium Development Goals - the provision of sufficient potable water and adequate sanitation to all Nigerians in an affordable and sustainable way through a cost sharing formula on investment and operational costs between government and the beneficiary.

Suffices is to say that Auchi community rely heavily on individuals‟ bore hole and water vendors for their sources of water supply. There is a near absence water utility in Auchi, but for the relics of the dysfunctional water utility board that is in Auchi. This has impacted negatively on the sanitary conditions of the sanitation toilets and the choice of sanitation toilets currently being used. It is worthy to note that all respondents that resulted to open field defecation, buys water from water vendors. Water supply and sanitation are central to improvements in so many aspects of human development, health, education, urban and rural development, development of industry and general economic development, (FRN, 2000).

(v). Open field defecation in spite of its numerous problems is still highly practiced in the study area especially in schools. It is worthy to note, that some public schools in Auchi do not have toilets, teachers and students of such schools result to open field defecation for their convenience.

(vi). The investigation of the effect of candidiasis infection on work and daily life of the respondents confirm or indicated statistical significance (0.000) at 99% confidence interval. This finding showed that there is very strong evidence that toilet infection can affect work and daily life of those infected.

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**5.2. Recommendations**

The following suggestions could be useful for future studies and implementation.

(i). There is the urgent need for a vigorous enlightenment drive in Auchi and its environs on Government policies and agreements by international communities as it relates to safe drinking-water and basic sanitation. "Knowledge they say is power"

(ii). There is urgent need for local health inspectors to constantly monitor the state of sanitary toilets facilities and ensure the availability of sanitation toilets in schools and homes. (iii). Following the severe consequences of poorly handled candidiasis cases, victims of candidiasis infection should be open to discussions on the issue and be ready to seek adequate medical advice and treatment.

(iv). Many individuals see sanitation toilets as a facility that must not be reckoned with, whereas, it is supposed to be the most decent facility within or around the house. Concerted effort should be made to ensure that sanitation toilets facilities are built with material that will allow for easy cleaning and disinfection, so as to keep toilets infectious organism at abeyance.

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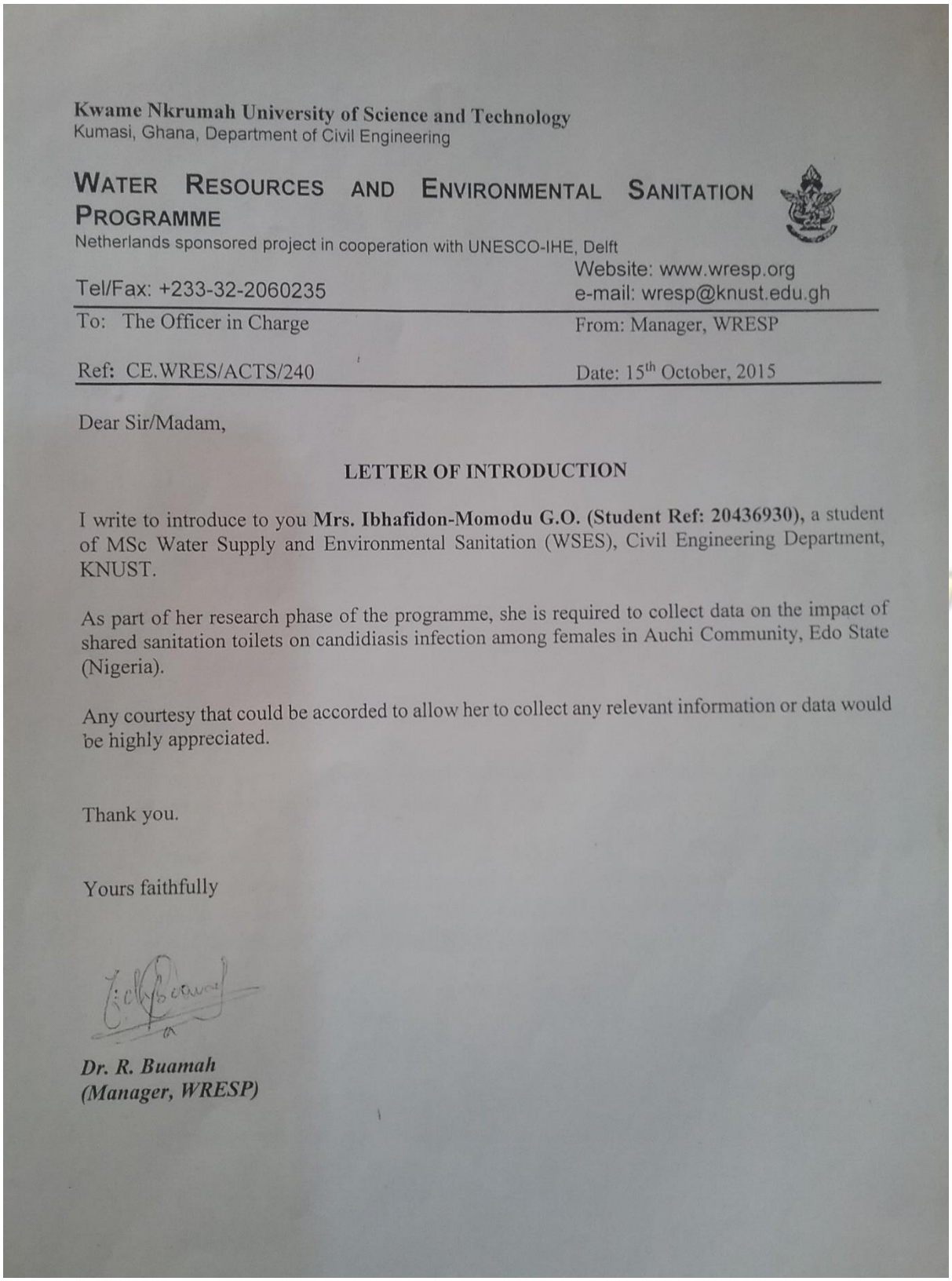
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# APPENDICE

## APPENDIX A Appendix A1: Letter of Introduction



**Kwame Nkrumah University of Science and Technology**
Kumasi, Ghana, Department of Civil Engineering

**WATER RESOURCES AND ENVIRONMENTAL SANITATION PROGRAMME**
Netherlands sponsored project in cooperation with UNESCO-IHE, Delft

Tel/Fax: +233-32-2060235
Website: www.wresp.org
e-mail: wresp@knust.edu.gh

To: The Officer in Charge
From: Manager, WRESP

Ref: CE.WRES/ACTS/240
Date: 15th October, 2015

Dear Sir/Madam,

**LETTER OF INTRODUCTION**

I write to introduce to you **Mrs. Ibhafidon-Momodu G.O. (Student Ref: 20436930),** a student of MSc Water Supply and Environmental Sanitation (WSES), Civil Engineering Department, KNUST.

As part of her research phase of the programme, she is required to collect data on the impact of shared sanitation toilets on candidiasis infection among females in Auchi Community, Edo State (Nigeria).

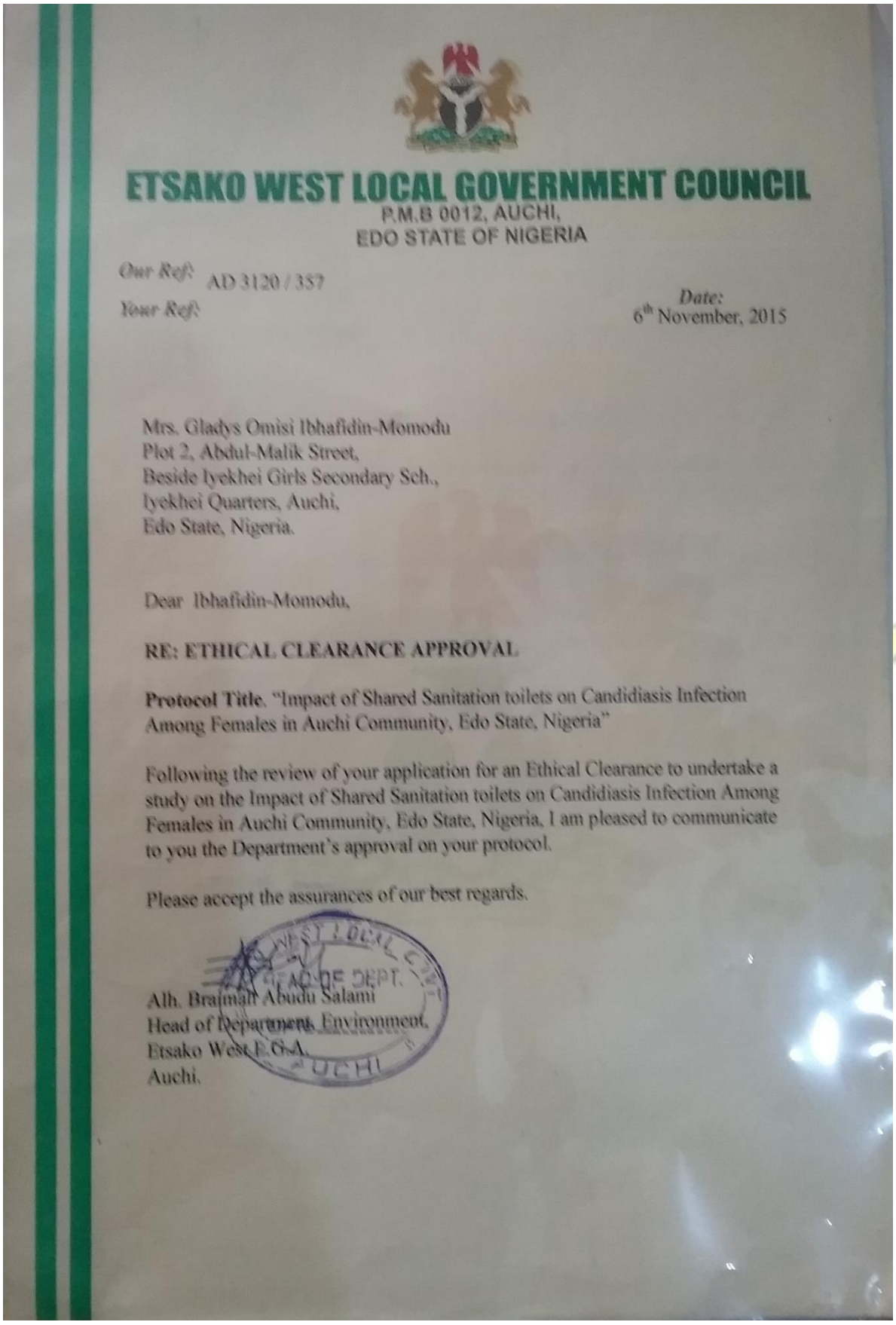
Any courtesy that could be accorded to allow her to collect any relevant information or data would be highly appreciated.

Thank you.

Yours faithfully

***Dr. R. Buamah***
***(Manager, WRESP)***

**Appendix A2: Ethical Clearance Approval**



**ETSAKO WEST LOCAL GOVERNMENT COUNCIL**
P.M.B 0012, AUCHI,
EDO STATE OF NIGERIA

*Our Ref:* AD 3120 / 357
*Your Ref:*

*Date:*
6th November, 2015

Mrs. Gladys Omisi Ibhafidin-Momodu
Plot 2, Abdul-Malik Street,
Beside Iyekhei Girls Secondary Sch.,
Iyekhei Quarters, Auchi,
Edo State, Nigeria.

Dear Ibhafidin-Momodu,

**RE: ETHICAL CLEARANCE APPROVAL**

**Protocol Title**. "Impact of Shared Sanitation toilets on Candidiasis Infection Among Females in Auchi Community, Edo State, Nigeria"

Following the review of your application for an Ethical Clearance to undertake a study on the Impact of Shared Sanitation toilets on Candidiasis Infection Among Females in Auchi Community, Edo State, Nigeria, I am pleased to communicate to you the Department's approval on your protocol.

Please accept the assurances of our best regards.

Alh. Brajmah Abudu Salami
Head of Department, Environment,
Etsako West L.G.A.
Auchi.

**Appendix A3: Survey Questionnaire**

IMPACT OF SHARED SANITATION TOILETS ON CANDIDIASIS INFECTION

AMONG FEMALES IN AUCHI COMMUNITY,

EDO STATE, NIGERIA

**FEMALES SURVEY QUESTIONNAIRE**

This questionnaire seeks to collect data on the influence of toilet technologies on shared toilet infections of females. Please read carefully and circle your choice of answer. Where answer options have not been provided please fill in the spaces provided below. Thanks for your cooperation.

**Personal data:**

1. Facility (a). Educational (b). Domestic
2. Suburb /Location (a). Utsogun (b). Akpekpe (c). Igbe (d). Iyekhei (e). Aibotse
3. Age (a). < 15 (b). 16 – 25 (c). 26 – 35 (d). 36 – 45 (e). 46 – 55 (f). >55
4. Respondent Occupation (a). Student (b). Teacher (c). Trader (e). Others
5. Respondent Educational Background (a). Primary (b). Secondary (c). Tertiary
6. Religion (a). Christian (b). Islam (c). Not Indicated

**Toilet data:**

7. How do you classify the toilet you use at home?

(a). Shared Household latrine (b). Shared Neighbourhood Latrine

(c). Shared public latrine (d). Single household latrine

8. What type of toilet facility do you use at home?

(a). Pit latrine (b). Ventilated Improved Pit latrine (VIP) (c). Open field defecation (OFD)

(d). Pour flush (e). Water closet

9. Where do you ease yourself when in the school?

(a). School toilets (b). Surrounding bushes (c). Toilet outside the school

10. What type of toilet do you use at school?

(a). Pit latrine (b). Ventilated Improve Pit Latrine (VIP) (c). Pour flush latrine

(d). water closet (e). Open field defecation (OFD)

11. How often do you use the school (or House) toilet? (a). Regularly (b). Seldomly (c). Never

12. If you do not use the school toilets, why?

(a). Fear of infectivity (b). It is not usually clean (c). No toilet

13. How often is the toilet facility cleaned?

(a). Daily (b). Weekly (c). Two or three times a week (d). Monthly (e). Not sure

14. Who cleans the toilet? (a). Individual users (b). Hired cleaners (c).Not sure

15. What do you do when the toilet is not clean?

(a). I will avoid it. (b). I will clean it (c). I will still use it

16. How will you grade the cleanness of the toilet facility (spilled urine, stained with excretes or pool of effluent)? (a). Poor (b). Fair (c). Good

17. How will you grade the odour level of the toilet?

(a). Poor (b) Fair (c). Good

18. What is your source of water supply?

(a). Utility (b). Bore hole (c). Hand dug well (d). Stream (e). Water vendors

(f). Others

19. What is the level of service of the water supply?

(a). Poor (b). Fair (c) Good

20. Which of the position do you use?

(a ) Sitting (b).Squatting (c). Standing

Why? (a). That is how the toilet should be used. (b). To avoid infection.

(c). the toilet is dirty.

21. Are you aware that there is a millennium development goal (MDG) to halve the people living without basic sanitation by 2015?

(a). Yes (b). No

**Infection data**

22. Are you aware that you can contact infection from the use of toilets?

(a). Yes (b). No

23. Have you experienced any infection from the use of shared toilets?

(a). Yes (b). No

24. If yes, please state the kind of infection. (a). Candidiasis (b). Trichomonasis

(c). Pelvic Inflammation Disease (d). Not sure of the infection 25.

Was it very serious? (a). Yes (b). No

26. What were some of the signs or symptoms of the infection?

(a). Itching (b). Discharge of mucus (c). Redness of Labia majora and Labia Minora

(d). Painful intercourse (e) All of the above

27. How did you treat the infection?

(a). Use of Oral Drugs (b). Use of Vagina pills (c). Use of (a) and ( b)

Did you experience re- infection after treatment? (a). Yes (b). No

How many times? .....

28. Can you tell whether the infection you contacted was from the facility you normally use or from elsewhere? (a). Normal facility (b). Elsewhere (c). Cannot tell

29. Which of the following do you do?

a. Washing the vagina with soap or Dittol
b. Frequent use of antibiotics(e.g. Amoxicillin)
c. Insertion of spices(e.g. ginger)
d. Use of perfumed sanitary products(e.g. pads, panty liners, toilet roll)
e. None of the above

30. Were you doing that (i.e. your answer in 30)

a. Before the infection

b. After the infection

c. It is a habit( i.e. something you do every day)

31. Please state the reasons behind your answer in question 30. (a). To keep the area neat (b). To avoid infection (c). It is a habit

32. How did the infection affect your work and daily life?

(a). No serious effect (b). Discomfort and loss of valuable man hours

33. Do you wash your hands with soap, water and wipe with clean napkin after using the toilet?

(a). Only Water(b). Soap and Water(c). Soap, Water and Napkin (d). None of the Above

35. How often do you wash your hands after using the toilet?

(a). Regularly (b). Sedomly (c). Never

36. Could you please volunteer high vagina swab (HVS) for Laboratory investigation?

(a). Yes (b). No

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**APPENDIX B Appendix B1: Laboratory Results for Shared Sanitation Toilet Facilities Cultured at $37^0$c for 24 Hours**

| Community | Type of Toilet Facility | Presence of Candida Albicans in targeted surfaces (Toilets) | | | | Presence of Candida Albicans |
|---|---|---|---|---|---|---|
| | | Insides | Walls | Floors | Handles | |
| 01A (Utsogun) | Pour flush | Negative | Negative | Negative | Negative | No Candida Detected |
| 01B (Utsogun) | Pit latrine | Negative | Negative | Negative | Negative | No Candida Detected |
| 01C (Utsogun) | Pit latrine | Negative | Negative | Negative | Negative | No Candida Detected |
| 02A (Akpekpe) | Pour flush | Negative | Negative | Negative | Negative | No Candida Detected |
| 02B (Akpekpe) | Pour flush | Positive | Negative | Negative | Negative | Candida Detected |
| 02C (Akpekpe) | Pit latrine | Negative | Negative | Negative | Negative | No Candida Detected |
| 03A (Igbe) | Ventilated improved pit latrine | Negative | Negative | Negative | Negative | No Candida Detected |
| 03C (Igbe) | Pit latrine | Negative | Negative | Negative | Negative | No Candida Detected |
| 04A (Iyekhei) | Ventilated improved pit latrine | Negative | Negative | Negative | Negative | No Candida Detected |
| 04C (Iyekhei) | Ventilated improved pit latrine | Negative | Negative | Negative | Negative | No Candida Detected |
| 05C (Aibotse) | Pit latrine | Negative | Negative | Negative | Negative | No Candida Detected |

**Appendix B2: Laboratory Results for Shared Sanitation Toilet Facilities Cultured at $37^0$c for 48 Hours**

| Community | Type of Toilet Facility | Presence of Candida Albicans in targeted surfaces (Toilets) | | | | Presence of Candida Albicans |
|---|---|---|---|---|---|---|
| | | Insides | Walls | Floors | Handles | |
| 01A (Utsogun) | Pour flush | Negative | Negative | Negative | Negative | No Candida Detected |
| 01B (Utsogun) | Pit latrine | Negative | Negative | Negative | Negative | No Candida Detected |
| 01C (Utsogun) | Pit latrine | Negative | Negative | Negative | Negative | No Candida Detected |
| 02A (Akpekpe) | Pour flush | Negative | Negative | Negative | Negative | No Candida Detected |
| 02B (Akpekpe) | Pour flush | Positive | Negative | Negative | Negative | Candida Detected |
| 02C (Akpekpe) | Pit latrine | Positive | Negative | Negative | Negative | Candida Detected |
| 03A (Igbe) | Ventilated improved pit latrine | Negative | Negative | Negative | Negative | No Candida Detected |
| 03C (Igbe) | Pit latrine | Negative | Negative | Negative | Negative | No Candida Detected |
| 04A (Iyekhei) | Ventilated improved pit latrine | Negative | Negative | Negative | Negative | No Candida Detected |
| 04C (Iyekhei) | Ventilated improved pit latrine | Negative | Negative | Negative | Negative | No Candida Detected |
| 05C (Aibotse) | Pit latrine | Positive | Positive | Negative | Negative | Candida Detected |

**Appendix B3: Laboratory Test Results of Sanitation Facilities**

| | Type of toilet facility | Period of incubation | Temperature | T(I) | T(W) | T(F) | T(H) | Result from culture |
|---|---|---|---|---|---|---|---|---|
| 01A (utsogun) | Pour flush | 24 hours | 37°c | Coliform organism | No growth | Coliform organism | No growth | No candida detected |
| | | 48 hours | 37°c | Coliform organism | No growth | Coliform organism | No growth | No candida detected |
| 01B (utsogun) | Pit latrine | 24 hours | 37°c | Coliform organism | Coliform organism | Coliform organism | Coliform organism | No candida detected |
| | | 48 hours | 37°c | Coliform organism | Coliform organism | Coliform organism | Coliform organism | No candida detected |
| 01C | Pit latrine | 24 hours | 37°c | No growth | No growth | Coliform organism | No growth | No candida detected |
| | | 48hours | 37°c | Coliform organim | No growth | Coliform organism | No growth | No candida detected |
| 02A | Pour flush | 24 hours | 37°c | Coliform organism | No growth | Coliform organism | No growth | No candida detected |
| | | 48 hours | 37°c | Coliform organism | No growth | Coliform organism | No growth | No candida detected |
| 02B | Pour flush | 24 hours | 37°c | Mix growth of coliform organisms and candida | Coliform organisms | Coliform organism | Coliform organisms | Candida detected |
| | | 48 hours | 37°c | Candida detected | Coliform organisms | Coliform organism | Coliform organisms | Candida detected |
| 02C | Pit latrine | 24 hours | 37°c | Coilform organism | Coliform organisms | Coliform organisms | Coliform organisms | Candida detected |
| | | 48 hours | 37°c | Coliform organisms and candida | Coliform organisms | Coliform organisms | Coliform organisms | Candida detected |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 03A | Ventilated improved pit latrine | 24 hours | 37°c | Coliform organisms | No growth | Coliform organisms | Coliform organisms | No candida detected |
| | | 48 hours | 37°c | Coliform organisms | No growth | Coliform organisms | Coliform organisms | No candida detected |
| 03C | Pit latrine | 24 hours | 37°c | Coliform organisms | No growth | Coliform organisms | No growth | No candida detected |
| | | 48 hours | 37°c | Coliform organisms | growth | Coliform organisms | No growth | No candida detected |
| 04A | Ventilated improved pit latrine | 24 hours | 37°c | Coliform organisms | Coliform organisms | Coliform organisms | No growth | No candida deteted |
| | | 48 hours | 37°c | Coliform organisms | Coliform organisms | Coliform organisms | No growth | No candida detected |
| 04C | Ventilated improved pit latrine | 24 hours | 37°c | Coliform organisms | No growth | Coliform organisms | Coliform organisms | No candida detected |
| | | 48 hours | 37°c | Coliform organisms | No growth | Coliform organisms | Coliform organisms | No candida detected |
| 05C | Pit latrine | 24 hours | 37°c | Coliform organisms | Coliform organisms | Coliform organisms | Coliform organisms | No Candida detected |
| | | 48 hours | 37°c | Coliform organisms and candida | Coliform organisms and candida | Coliform organisms | Coliform organisms | Candida detected |

**Appendix B4: Test Result of High Vagina Swabs (HVS)**

| Location/ | Wet Film | Gram Stain | Culture | Sensitivity |
|---|---|---|---|---|

| Sample Label | Pus cells | Red blood cells | Epithalia cells | Monilia cells | Trachomonas virginalis | Positive rods | Yielded | |
|---|---|---|---|---|---|---|---|---|
| 01utsogun | | | | | | | | |
| 01HVS(1) | Nil | Nil | ++ | Nil | Nil | ++ | Normal flora only | - |
| 01HVS(2) | Nil | Nil | + | Nil | Nil | + | Normal flora only | - |
| 01HVS(3) | Nil | Nil | + | Nil | Nil | + | Normal flora only | - |
| 01HVS(4) | Nil | Nil | ++ | +With oil droplets ++ | Nil | + and monilia | Candida Albicans + | Fluconazole, gynotryvogen,canesten |
| 01HVS(5) | Nil | Nil | + | + | Nil | + and monilia | Candida Albicans + | Fluconazole, gynotryvogen, canesten |
| 01HVS(6) | Nil | Nil | + | Nil | Nil | + | Normal flora only | |
| 02Akpekpe | | | | | | | | |
| 02HVS(1) | Nil | Nil | + | Nil | Nil | + | Normal flora only | - |
| 02HVS(2) | Nil | Nil | ++ | Nil | Nil | + | Normal flora | - |
| 02HVS(3) | Nil | Nil | + | Nil | Nil | + | Normal flora only | - |
| 02HVS(4) | Nil | Nil | ++ | Nil | Nil | + | Normal flora only | - |
| 02HVS(5) | Nil | Nil | + | Nil | Nil | + | Normal flora only | - |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 02HVS(6) | Nil | Nil | ++ | Nil | Nil | + | Normal flora only | - |
| 03Igbe | | | | | | | | |
| 03HVS(1) | Nil | Nil | ++ | + | Nil | + | Candida Albicans + | Fluconazole, cansetengynotryvogen |
| 04Iyekhei | | | | | | | | |
| 04HVS(1) | Nil | Nil | ++ | + | Nil | + | Candida Albicans + | Fluconazol, canesten, gynotryvogen |
| 04HVS(2) | Nil | Nil | Nil | Nil | Nil | + | Normal flora only | - |
| 04HVS(3) | Nil | Nil | ++ | Nil | Nil | + | Normal flora only | - |
| 04HVS(4) | Nil | Nil | ++ | Nil | Nil | + | Normal flora only | - |
| 04HVS(5) | Nil | Nil | + | Nil | Nil | + | Normal flora only | - |
| 05Aibotse | | | | | | | | |
| 05HVS(1) | Nil | Nil | ++ | + | Nil | + | Candida Albicans + | Fluconazole, canesten, gynotryvogen |
| 05HVS(2) | Nil | Nil | Nil | Nil | Nil | + | Normal flora only | - |
| 05HVS(3) | Nil | Nil | ++ | Nil | Nil | + | Normal flora only | - |
| 05HVS(4) | Nil | Nil | ++ | Nil | Nil | + | Normal flora only | - |

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Key: SampledLabelCode :- [Location]{Targeted Surface}(S/No; if more than one) **Appendix B5: Hygienic Conditions of Toilets in Educational Institutions**

| **Location** | **Type of Toilet** | **Targeted Surface Inspected for its Hygienic Condition** | | | |
|---|---|---|---|---|---|
| | | **T(I) Insides** | **T(W) Walls** | **T(F) Floors** | **T(H) Handles** |
| 01A(Utsogun) | Pour flush | The squat hole is neat and free from stains. | Walls are very neat. There are tiles on the walls. | The floor is dry and neat. There are tiles are on the floor. | The handles and lock are dry and neat. |
| 01B (Utsogun) | Pit latrine | The squat hole is not neat although it has a cover to prevent it from flies. | Walls are very dirty and stained with excreta. | The floor is wet, with pools of urine and presence of flies. There are no tiles on floor. | Door handles and locks are dry but not neat. |
| 02A (Akpekpe) | Pour flush | Squat hole is not neat, it is stained with excreta. | Walls are very dirty and stained with excreta. There are no tiles. | Floor is wet and stained with pools of effluent and presence of house flies, there no tiles | Handles and locks are dry but not neat. |
| 02B (Akpekpe) | Pour flush | Squat hole is neat and free from stains. | Walls are very neat and free from stains. | Floor is neat and dry although no tiles and no flies. | Handles and locks are dry and neat. |
| 03A (Igbe) | Ventilated improved latrine (VIP) | Squat hole is very dirty and stained with excreta. | Walls are very dirty and stained with excreta. | Floor is wet with pools of urine and disinfectant which does not allow flies. | Handles and locks are very dry and dirty. |
| 04A (Iyekhei) | Ventilated improved pit latrine (VIP) | Squat hole is dirty and stained with excreta. | Walls are dirty and stained with excreta. | Floor is wet with pools of effluent and presence of houseflies and cleansing materials are all over the floor. There are no tiles. | Handles and locks are dry and dirty. |

**Appendix B6: Hygienic Conditions of Toilets in Domestic**

| Location | Type of Toilet | Targeted Surface Inspected for its Hygienic Condition | | | |
|---|---|---|---|---|---|
| | | T(I) Insides | T(W) Walls | T(F) Floors | T(H) Handles |
| 01C (Utsogun) | Pit latrine | Squat hole is not neat at all but stained with excreta. | Wallsare made of old zinc and it generates heat in the toilet. | Floor is stained with pools of effluent and presence of houseflies. | Handles and locks are dry and dirty. |
| 02C (Akpekpe) | Pit latrine | Squat hole is stained with excreta. | Wallsare made of old zinc that generates heat in the toilet. | Floor is wet and stained with pools of effluent and presence of houseflies. Broken tiles are used on floors which make the cleaning difficult. | Handles and locks are dry and very dirty. |
| 03C (Igbe) | Pit latrine | Squat hole is neat but it has a bad odour. | Wallsare made of old zinc that generates heat in the toilet. | Floor is wet with pools of effluent and presence of houseflies. There are no tiles. | Handles and locks are dry and dirty. |
| 04C (Iyekhei) | Ventilated improved pit latrine (VIP) | Squat hole is dirty and stained with excreta. | Wallsare dirty and stained with excreta. There are no tiles on the wall. | Floor is wet with pools of effluent and presence of houseflies. There are no tiles on the floor. | Handles and locks are dry and dirty. |
| 05C (Aibotse) | Pit latrine | Squat hole is very dirty and stained with excreta. | Walls are dirty and stained with excreta. | Floor is wet with pools of effluent and presence of houseflies. There are no tiles on the floor. | Handles and locks are dry and dirty. |

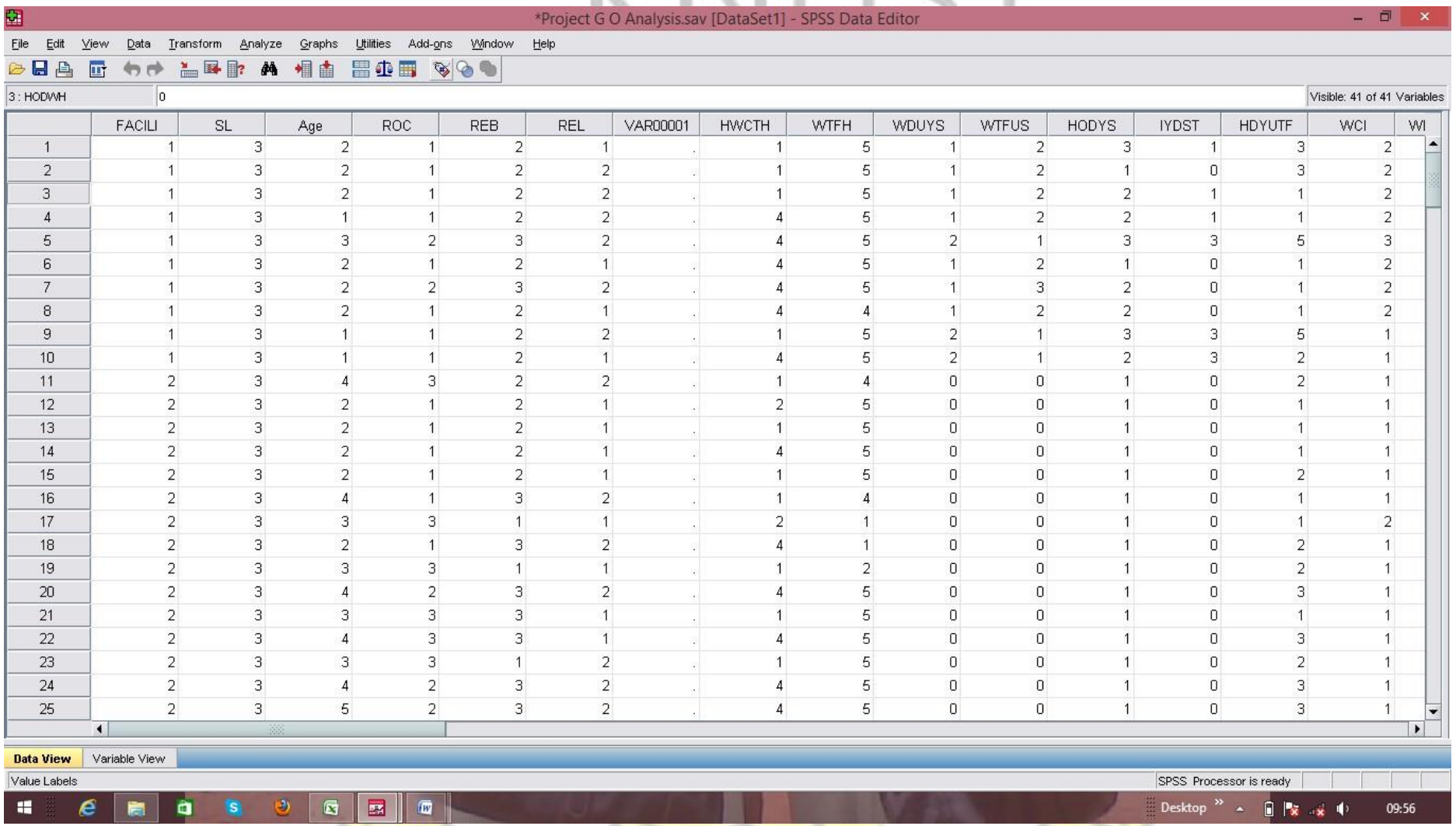
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# APPENDIX C

**Appendix C1: Statistical Package for Social Sciences (SPSS) Version 16.0 Data Coding.**



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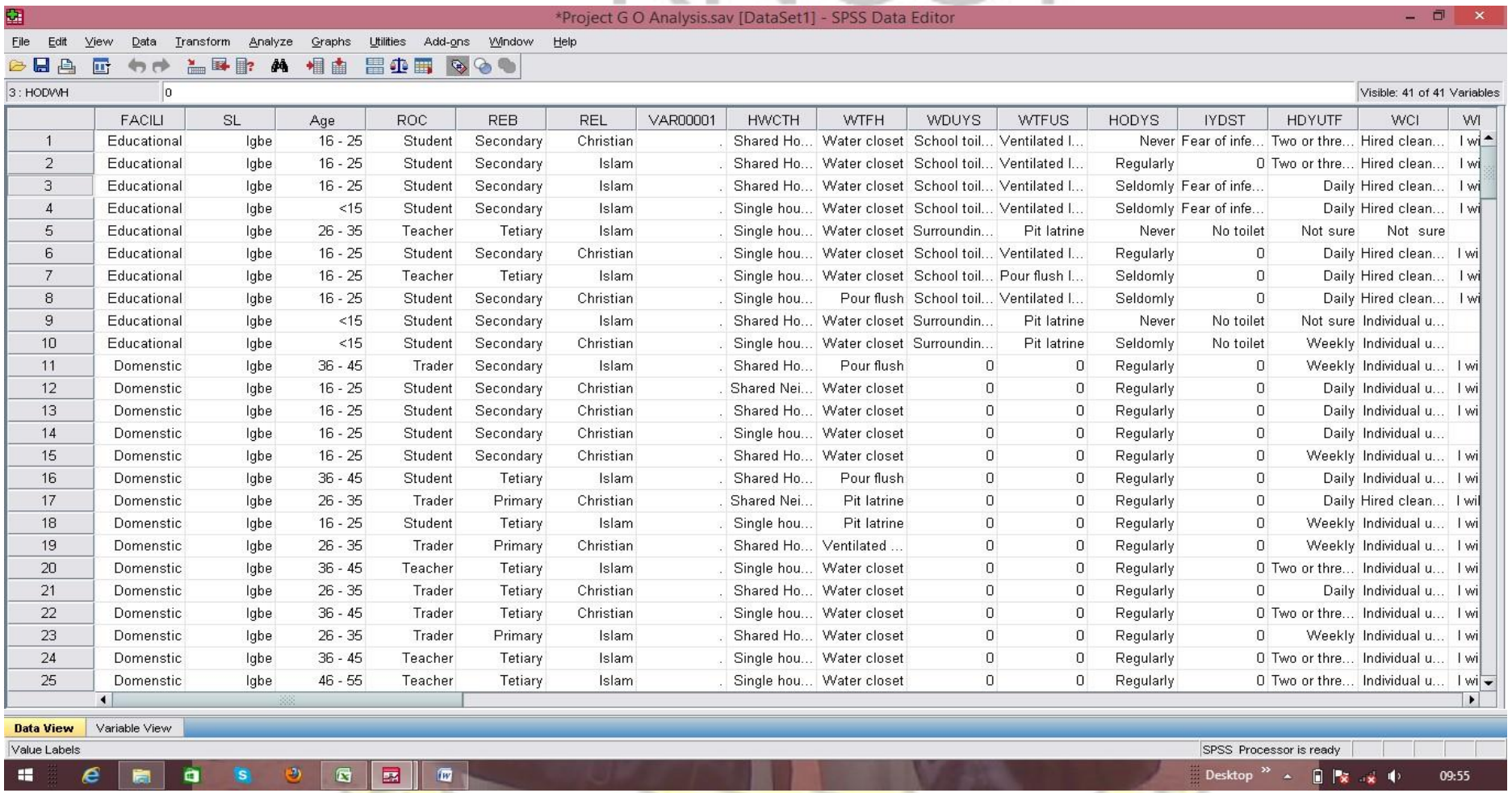



| | FACILI | SL | Age | ROC | REB | REL | VAR00001 | HWCTH | WTFH | WDUYS | WTFUS | HODYS | IYDST | HDYUTF | WCI | WI |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 3 | 2 | 1 | 2 | 1 | . | 1 | 5 | 1 | 2 | 3 | 1 | 3 | 2 | |
| 2 | 1 | 3 | 2 | 1 | 2 | 2 | . | 1 | 5 | 1 | 2 | 1 | 0 | 3 | 2 | |
| 3 | 1 | 3 | 2 | 1 | 2 | 2 | . | 1 | 5 | 1 | 2 | 2 | 1 | 1 | 2 | |
| 4 | 1 | 3 | 1 | 1 | 2 | 2 | . | 4 | 5 | 1 | 2 | 2 | 1 | 1 | 2 | |
| 5 | 1 | 3 | 3 | 2 | 3 | 2 | . | 4 | 5 | 2 | 1 | 3 | 3 | 5 | 3 | |
| 6 | 1 | 3 | 2 | 1 | 2 | 1 | . | 4 | 5 | 1 | 2 | 1 | 0 | 1 | 2 | |
| 7 | 1 | 3 | 2 | 2 | 3 | 2 | . | 4 | 5 | 1 | 3 | 2 | 0 | 1 | 2 | |
| 8 | 1 | 3 | 2 | 1 | 2 | 1 | . | 4 | 4 | 1 | 2 | 2 | 0 | 1 | 2 | |
| 9 | 1 | 3 | 1 | 1 | 2 | 2 | . | 1 | 5 | 2 | 1 | 3 | 3 | 5 | 1 | |
| 10 | 1 | 3 | 1 | 1 | 2 | 1 | . | 4 | 5 | 2 | 1 | 2 | 3 | 2 | 1 | |
| 11 | 2 | 3 | 4 | 3 | 2 | 2 | . | 1 | 4 | 0 | 0 | 1 | 0 | 2 | 1 | |
| 12 | 2 | 3 | 2 | 1 | 2 | 1 | . | 2 | 5 | 0 | 0 | 1 | 0 | 1 | 1 | |
| 13 | 2 | 3 | 2 | 1 | 2 | 1 | . | 1 | 5 | 0 | 0 | 1 | 0 | 1 | 1 | |
| 14 | 2 | 3 | 2 | 1 | 2 | 1 | . | 4 | 5 | 0 | 0 | 1 | 0 | 1 | 1 | |
| 15 | 2 | 3 | 2 | 1 | 2 | 1 | . | 1 | 5 | 0 | 0 | 1 | 0 | 2 | 1 | |
| 16 | 2 | 3 | 4 | 1 | 3 | 2 | . | 1 | 4 | 0 | 0 | 1 | 0 | 1 | 1 | |
| 17 | 2 | 3 | 3 | 3 | 1 | 1 | . | 2 | 1 | 0 | 0 | 1 | 0 | 1 | 2 | |
| 18 | 2 | 3 | 2 | 1 | 3 | 2 | . | 4 | 1 | 0 | 0 | 1 | 0 | 2 | 1 | |
| 19 | 2 | 3 | 3 | 3 | 1 | 1 | . | 1 | 2 | 0 | 0 | 1 | 0 | 2 | 1 | |
| 20 | 2 | 3 | 4 | 2 | 3 | 2 | . | 4 | 5 | 0 | 0 | 1 | 0 | 3 | 1 | |
| 21 | 2 | 3 | 3 | 3 | 3 | 1 | . | 1 | 5 | 0 | 0 | 1 | 0 | 1 | 1 | |
| 22 | 2 | 3 | 4 | 3 | 3 | 1 | . | 4 | 5 | 0 | 0 | 1 | 0 | 3 | 1 | |
| 23 | 2 | 3 | 3 | 3 | 1 | 2 | . | 1 | 5 | 0 | 0 | 1 | 0 | 2 | 1 | |
| 24 | 2 | 3 | 4 | 2 | 3 | 2 | . | 4 | 5 | 0 | 0 | 1 | 0 | 3 | 1 | |
| 25 | 2 | 3 | 5 | 2 | 3 | 2 | . | 4 | 5 | 0 | 0 | 1 | 0 | 3 | 1 | |

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**Appendix C2: Statistical Package for Social Sciences (SPSS) Version 16.0 Window**




| | FACILI | SL | Age | ROC | REB | REL | VAR00001 | HWCTH | WTFH | WDUYS | WTFUS | HODYS | IYDST | HDYUTF | WCI | WI |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Educational | Igbe | 16 - 25 | Student | Secondary | Christian | . | Shared Ho... | Water closet | School toil... | Ventilated l... | Never | Fear of infe... | Two or thre... | Hired clean... | I wi |
| 2 | Educational | Igbe | 16 - 25 | Student | Secondary | Islam | . | Shared Ho... | Water closet | School toil... | Ventilated l... | Regularly | 0 | Two or thre... | Hired clean... | I wi |
| 3 | Educational | Igbe | 16 - 25 | Student | Secondary | Islam | . | Shared Ho... | Water closet | School toil... | Ventilated l... | Seldomly | Fear of infe... | Daily | Hired clean... | I wi |
| 4 | Educational | Igbe | <15 | Student | Secondary | Islam | . | Single hou... | Water closet | School toil... | Ventilated l... | Seldomly | Fear of infe... | Daily | Hired clean... | I wi |
| 5 | Educational | Igbe | 26 - 35 | Teacher | Tetiary | Islam | . | Single hou... | Water closet | Surroundin... | Pit latrine | Never | No toilet | Not sure | Not sure | |
| 6 | Educational | Igbe | 16 - 25 | Student | Secondary | Christian | . | Single hou... | Water closet | School toil... | Ventilated l... | Regularly | 0 | Daily | Hired clean... | I wi |
| 7 | Educational | Igbe | 16 - 25 | Teacher | Tetiary | Islam | . | Single hou... | Water closet | School toil... | Pour flush l... | Seldomly | 0 | Daily | Hired clean... | I wi |
| 8 | Educational | Igbe | 16 - 25 | Student | Secondary | Christian | . | Single hou... | Pour flush | School toil... | Ventilated l... | Seldomly | 0 | Daily | Hired clean... | I wi |
| 9 | Educational | Igbe | <15 | Student | Secondary | Islam | . | Shared Ho... | Water closet | Surroundin... | Pit latrine | Never | No toilet | Not sure | Individual u... | |
| 10 | Educational | Igbe | <15 | Student | Secondary | Christian | . | Single hou... | Water closet | Surroundin... | Pit latrine | Seldomly | No toilet | Weekly | Individual u... | |
| 11 | Domenstic | Igbe | 36 - 45 | Trader | Secondary | Islam | . | Shared Ho... | Pour flush | 0 | 0 | Regularly | 0 | Weekly | Individual u... | I wi |
| 12 | Domenstic | Igbe | 16 - 25 | Student | Secondary | Christian | . | Shared Nei... | Water closet | 0 | 0 | Regularly | 0 | Daily | Individual u... | I wi |
| 13 | Domenstic | Igbe | 16 - 25 | Student | Secondary | Christian | . | Shared Ho... | Water closet | 0 | 0 | Regularly | 0 | Daily | Individual u... | I wi |
| 14 | Domenstic | Igbe | 16 - 25 | Student | Secondary | Christian | . | Single hou... | Water closet | 0 | 0 | Regularly | 0 | Daily | Individual u... | |
| 15 | Domenstic | Igbe | 16 - 25 | Student | Secondary | Christian | . | Shared Ho... | Water closet | 0 | 0 | Regularly | 0 | Weekly | Individual u... | I wi |
| 16 | Domenstic | Igbe | 36 - 45 | Student | Tetiary | Islam | . | Shared Ho... | Pour flush | 0 | 0 | Regularly | 0 | Daily | Individual u... | I wi |
| 17 | Domenstic | Igbe | 26 - 35 | Trader | Primary | Christian | . | Shared Nei... | Pit latrine | 0 | 0 | Regularly | 0 | Daily | Hired clean... | I wi |
| 18 | Domenstic | Igbe | 16 - 25 | Student | Tetiary | Islam | . | Single hou... | Pit latrine | 0 | 0 | Regularly | 0 | Weekly | Individual u... | I wi |
| 19 | Domenstic | Igbe | 26 - 35 | Trader | Primary | Christian | . | Shared Ho... | Ventilated ... | 0 | 0 | Regularly | 0 | Weekly | Individual u... | I wi |
| 20 | Domenstic | Igbe | 36 - 45 | Teacher | Tetiary | Islam | . | Single hou... | Water closet | 0 | 0 | Regularly | 0 | Two or thre... | Individual u... | I wi |
| 21 | Domenstic | Igbe | 26 - 35 | Trader | Tetiary | Christian | . | Shared Ho... | Water closet | 0 | 0 | Regularly | 0 | Daily | Individual u... | I wi |
| 22 | Domenstic | Igbe | 36 - 45 | Trader | Tetiary | Christian | . | Single hou... | Water closet | 0 | 0 | Regularly | 0 | Two or thre... | Individual u... | I wi |
| 23 | Domenstic | Igbe | 26 - 35 | Trader | Primary | Islam | . | Shared Ho... | Water closet | 0 | 0 | Regularly | 0 | Weekly | Individual u... | I wi |
| 24 | Domenstic | Igbe | 36 - 45 | Teacher | Tetiary | Islam | . | Single hou... | Water closet | 0 | 0 | Regularly | 0 | Two or thre... | Individual u... | I wi |
| 25 | Domenstic | Igbe | 46 - 55 | Teacher | Tetiary | Islam | . | Single hou... | Water closet | 0 | 0 | Regularly | 0 | Two or thre... | Individual u... | I wi |

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**Appendix C3: Type of Toilet used at home* Class of Toilet Cross tabulation**

| | | | Class of Toilet | | | |
|---|---|---|---|---|---|---|
| | | | Shared Household latrine | Shared Neighbourhood Latrine | Single house hold latrine | Total |
| Type of Toilet | Pit latrine | Count | 13 | 12 | 8 | 33 |
| | | Expected Count | 11.6 | 6.0 | 15.5 | 33.0 |
| | | % within Type of Toilet use at Home | 39.4% | 36.4% | 24.2% | 100.0% |
| | Ventilated Improved pit latrine (VIP) | Count | 8 | 2 | 0 | 10 |
| | | Expected Count | 3.5 | 1.8 | 4.7 | 10.0 |
| | | % within Type of Toilet use at Home | 80.0% | 20.0% | .0% | 100.0% |
| | Open field defecation (OFD) | Count | 2 | 4 | 0 | 6 |
| | | Expected Count | 2.1 | 1.1 | 2.8 | 6.0 |
| | | % within Type of Toilet use at Home | 33.3% | 66.7% | .0% | 100.0% |
| | Pour flush | Count | 16 | 12 | 5 | 33 |
| | | Expected Count | 11.6 | 6.0 | 15.5 | 33.0 |
| | | % within Type of Toilet use at Home | 48.5% | 36.4% | 15.2% | 100.0% |
| | Water closet | Count | 33 | 7 | 83 | 123 |

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| | | | | | |
|---|---|---|---|---|---|
| | Expected Count | 43.2 | 22.2 | 57.6 | 123.0 |
| | % within Type of Toilet use at Home | 26.8% | 5.7% | 67.5% | 100.0% |
| Total | Count | 72 | 37 | 96 | 205 |
| | Expected Count | 72.0 | 37.0 | 96.0 | 205.0 |
| | % within Type of Toilet use at Home | 35.1% | 18.0% | 46.8% | 100.0% |

**Chi-Square Tests**

| | Value | df | Asymp. Sig. (2-sided) |
|---|---|---|---|
| Pearson Chi-Square | 69.909[a] | 8 | .000 |
| Likelihood Ratio | 75.641 | 8 | .000 |
| Linear-by-Linear Association | 23.263 | 1 | .000 |
| N of Valid Cases | 205 | | |

a. 6 cells (40.0%) have expected count less than 5. The minimum expected count is 1.08.

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**Appendix C4: Type of Toilet used at Home * Whatis your source of water supply?**

| | | | What is your source of water supply? | | | |
|---|---|---|---|---|---|---|
| | | | Bore hole | Hand dug well | Water vendors | Total |
| Type of Toilet use at Home | Pit latrine | Count | 13 | 9 | 11 | 33 |
| | | Expected Count | 15.0 | 2.3 | 15.8 | 33.0 |
| | | % within Type of Toilet use at Home | 39.4% | 27.3% | 33.3% | 100.0% |
| | Ventilated pit latrine (VIP) | Count | 5 | 1 | 4 | 10 |
| | | Expected Count | 4.5 | .7 | 4.8 | 10.0 |
| | | % within Type of Toilet use at Home | 50.0% | 10.0% | 40.0% | 100.0% |
| | Open field defecation (OFD) | Count | 0 | 0 | 6 | 6 |
| | | Expected Count | 2.7 | .4 | 2.9 | 6.0 |
| | | % within Type of Toilet use at Home | .0% | .0% | 100.0% | 100.0% |
| | Pour flush | Count | 20 | 0 | 13 | 33 |
| | | Expected Count | 15.0 | 2.3 | 15.8 | 33.0 |
| | | % within Type of Toilet use at Home | 60.6% | .0% | 39.4% | 100.0% |
| | Water closet | Count | 55 | 4 | 64 | 123 |
| | | Expected Count | 55.8 | 8.4 | 58.8 | 123.0 |

| | | | | | |
|---|---|---|---|---|---|
| | % within Type of Toilet use at Home | 44.7% | 3.3% | 52.0% | 100.0% |
| Total | Count | 93 | 14 | 98 | 205 |
| | Expected Count | 93.0 | 14.0 | 98.0 | 205.0 |
| | % within Type of Toilet use at Home | 45.4% | 6.8% | 47.8% | 100.0% |

**Chi-Square Tests**

| | Value | df | Asymp. Sig. (2-sided) |
|---|---|---|---|
| Pearson Chi-Square | 35.981[a] | 8 | .000 |
| Likelihood Ratio | 32.364 | 8 | .000 |
| Linear-by-Linear Association | .850 | 1 | .357 |
| N of Valid Cases | 205 | | |

a. 8 cells (53.3%) have expected count less than 5. The minimum expected count is .41.

| | Value | Asymp. Std. Error[a] | Approx. T[b] | Approx. Sig. |
|---|---|---|---|---|
| Interval by Interval Pearson's R | .065 | .065 | .922 | .358[c] |
| Ordinal by Ordinal Spearman Correlation | .052 | .068 | .749 | .455[c] |
| N of Valid Cases | 205 | | | |

**Symmetric Measures**

a. Not assuming the null hypothesis.

b. Using the asymptotic standard error assuming the null hypothesis.

c. Based on normal approximation.

**Appendix C5: Volunteer high vagina swab (HVS) for Laboratory investigation. How did the infection affect your work and daily life? Cross tabulation**

| | | | How did the infection affect your work and daily life? | | | |
|---|---|---|---|---|---|---|
| | | | Not applicable | No serious effect | Discomfort and lost of valuable man hours | Total |
| volunteer high vagina swab (HVS) for | Not applicable | Count | 117 | 1 | 2 | 120 |
| | | Expected Count | 70.2 | 13.5 | 36.3 | 120.0 |

| | | | | | | |
|---|---|---|---|---|---|---|
| Laboratory investigation? | | % within volunteer high vagina swab (HVS) for Laboratory investigation? | 97.5% | .8% | 1.7% | 100.0% |
| | Yes | Count | 0 | 3 | 19 | 22 |
| | | Expected Count | 12.9 | 2.5 | 6.7 | 22.0 |
| | | % within volunteer high vagina swab (HVS) for Laboratory investigation? | .0% | 13.6% | 86.4% | 100.0% |
| | No | Count | 3 | 19 | 41 | 63 |
| | | Expected Count | 36.9 | 7.1 | 19.1 | 63.0 |
| | | % within volunteer high vagina swab (HVS) for Laboratory investigation? | 4.8% | 30.2% | 65.1% | 100.0% |
| Total | | Count | 120 | 23 | 62 | 205 |
| | | Expected Count | 120.0 | 23.0 | 62.0 | 205.0 |
| | | % within volunteer high vagina swab (HVS) for Laboratory investigation? | 58.5% | 11.2% | 30.2% | 100.0% |

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**Chi-Square Tests**

| | Value | df | Asymp. Sig. (2-sided) |
|---|---|---|---|
| Pearson Chi-Square | 1.875E2[a] | 4 | .000 |
| Likelihood Ratio | 228.995 | 4 | .000 |
| Linear-by-Linear Association | 138.077 | 1 | .000 |
| N of Valid Cases | 205 | | |

a. 1 cells (11.1%) have expected count less than 5. The minimum expected count is 2.47.

**Symmetric Measures**

| | Value | Asymp. Std. Error[a] | Approx. T[b] | Approx. Sig. |
|---|---|---|---|---|
| Interval by Interval Pearson's R | .823 | .030 | 20.620 | .000[c] |
| Ordinal by Ordinal Spearman Correlation | .875 | .029 | 25.723 | .000[c] |
| N of Valid Cases | 205 | | | |

a. Not assuming the null hypothesis.

b. Using the asymptotic standard error assuming the null hypothesis.

c. Based on normal approximation.

**Appendix C6 : Class of Toilet used at Home**

| Class of Toilet | Frequency | Percent |
|---|---|---|
| Shared household latrine | 72 | 35.1 |
| Shared neighbourhood latrine | 37 | 18 |
| Single house hold latrine | 96 | 46.8 |
| Total | 205 | 100 |

**Appendix C7: Type of Toilet used at Home**

| Type of Toilet | Frequency | Percent |
|---|---|---|
| Pit latrine | 33 | 16.1 |
| Ventilated Improved Pit Latrine (VIP) | 10 | 4.9 |
| Open field defecation (OFD) | 6 | 2.9 |
| Pour flush | 33 | 16.1 |
| Water closet | 123 | 60 |
| Total | 205 | 100 |

**Appendix C8: Type of toilet used at school.**

| Type of Toilet | Frequency | Percent |
|---|---|---|
| Non-Schooling Respondents | 122 | 59.5 |
| Pit latrine | 13 | 6.3 |
| Ventilated Improved Pit Latrine (VIP) | 6 | 2.9 |

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| | | |
|---|---|---|
| Open field defecation (OFD) | 21 | 10 |
| Pour flush | 39 | 19 |
| Water closet | 4 | 2 |
| Total | 205 | 100 |

**Appendix C9: How often do you use the school (or House) toilet?**

| **Frequency of Use** | **Number of Respondents** | **Percentage** |
|---|---|---|
| Regularly | 136 | 66.3 |
| Seldom | 43 | 21 |
| Never | 26 | 12.7 |
| Total | 205 | 100 |

**Appendix C10: How often do you use the House toilet?**

| **Frequency of Use** | **Number of Respondents** | **Percentage** |
|---|---|---|
| Regularly | 199 | 97.1 |
| Seldom | 6 | 2.9 |
| Never | 0 | 0.0 |
| Total | 205 | 100 |

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**Appendix C11: How often is the toilet facility cleaned?**

| Cleaning Frequency | Number of Respondents | Percent |
|---|---|---|
| Not sure | 20 | 9.7 |
| Daily | 80 | 39 |
| Weekly | 70 | 34.1 |
| Two or three times a week | 24 | 11.7 |
| Monthly | 11 | 5.4 |
| Two or three times a week | 24 | 11.7 |
| Total | 205 | 100 |

**Appendix C12: Which of the position do you use?**

| Toilet Position | Frequency | Percent |
|---|---|---|
| Sitting | 78 | 38 |
| Squatting | 119 | 58 |
| Standing | 8 | 3.9 |
| Total | 205 | 100 |

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