

Title: Promoting Sanitation and Nutrient Recovery through Urine Separation: The Role of Health and Hygiene Education in the Acceptance, Utilisation, and Maintenance of Urine Diversion Toilets (UDDT) in Rural Communities of KwaZulu Natal (KZN)

Submitted to:

Discipline of Public Health Medicine

University of KwaZulu-Natal Durban

South Africa

Submitted in partial fulfilment of the academic requirements for the degree:

Master in Medical Science

BY

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April 2017

Declaration

I declare that this Master of Medical Science work is my own work and all primary and secondary sources have been appropriately acknowledged. This dissertation has not been submitted anywhere else as part of the academic qualification.

This Dissertation is prepared in partial fulfilment of the requirement of the Master of Medical Science Degree, School of Nursing and Public Health, College of Health Sciences, University of KwaZulu-Natal, Durban South Africa.

April 2017

Signature

Acknowledgements

First and foremost I would like to thank the Bill and Melinda Gates Foundation for funding the VUNA project and improving sanitation in South Africa and making the success of the project possible. I would also like to thank the VUNA team for your unwavering support, I truly appreciate it, and you have contributed greatly to the success of my project.

I would like to pass my deepest gratitude to my Manager at eThekwin Water and Sanitation Mr Teddy Gounden for presenting this opportunity and supporting me every step of the way. My gratitude also goes to the four ward councillors for permitting us to work in their communities. My heart also goes to the community for welcoming us into their homes, participating in the study and giving us their full cooperation, I am sincerely thankful. The eThekwin Water and Sanitation team namely Scelo Xulu, Siyaphila Zuma, Anele, Yolanda, Cebo Gumbi, Lindiwe Gumede, Phindile Zwane, Silindile Radebe and Lerato Mateza played a huge role in the implementation of the project.

Professor Myra Taylor my supervisor, I'm deeply honoured and privileged that you have been by my side throughout this journey and I have learned so much from your commitment, I'm truly grateful.

Last but not last the support from my husband and my children has been amazing, thank you for giving me the space and time when I needed it.

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List of presentations

The presentations listed below are where the student presented the findings of the study.

2nd International Faecal Sludge Management Conference 2012, International Conference Centre, Durban, South Africa, 29 – 31 October 2012. Title: Promoting sanitation and nutrient recovery through urine separation: the role of health and hygiene education in the acceptance, utilisation and maintenance of the UDDT in the rural communities of kwaZulu Natal.

Eawag-Swiss Federal Institute of Aquatic Science and Technology Forum, Switzerland, Zurich 25; 26 and 27th September 2013. Title: Role of Health and Hygiene Education in UD Utilisation

WISA Biennial Conference 22 May 2014, Mbombela, Mpumalanga, South Africa.
Promoting sanitation and nutrient recovery through urine separation: The role of health and hygiene education and social acceptance factors.

eThekwini-University Research Symposium, 21-22 November 2013. Title: Utilisation of UDDT after receiving health and hygiene education.

Symposium on Promoting Sanitation and Nutrient Recovery through Urine Separation, 27 August 2015. Title: Acceptance, use and maintenance of urine diversion dry toilet (UDDT) at eThekwini Municipality.

College of Health Sciences Research Symposium, University of KwaZulu Natal 10-11 September 2015. Title: Acceptance, use and maintenance of urine diversion dry toilet (UDDT) at eThekwini Municipality

WISA Biennial Conference Durban Exhibition: water the ultimate constraint 15-19 May 2016. Title: Health and Hygiene Education as a tool to promote acceptance, use and maintenance of the Urine Diversion Dry Toilet (UDDT).

List of acronyms

AIDS	Acquired Immunodeficiency Syndrome
AMCOW	African Ministers' Council on Water
CCG	Community Care Giver
CLTS	Community Led Total Sanitation
CREPA	Chinese Real Estate Professionals Association
DA	Democratic Alliance
DIY	Do it yourself
DOH	Department of Health
DWAF	Department of Water Affairs and Forestry
EcoSan	Ecological Sanitation Technologies
EM	eThekweni Municipality
EWS	eThekweni Water and Sanitation
FGD	Focus Group Discussion
GTZ	German Technical Corporation
HIV	Human Immunodeficiency Virus
HH	Household
HST	Human Systems Trust
HWWS	Hand washing with Soap
IDI	In-depth Interview
IDS	Institute of Development Studies
ISD	Institute for Social Development
KZN	KwaZulu-Natal
MDG	Millennium Development Goal
NSTT	National Sanitation Task Team
ODF	Open Defaecation Free
OD	Open Defaecation

PHAST	Participatory Hygiene and Sanitation Transformation
PSC	Public Service Commission
PSO	Particle Swarm Optimization
SA	South Africa
SDG	Sustainable Development Goals
SSWM	Sustainable Sanitation and Water Management
UD	Urine Diversion
UDDT	Urine Diversion Dry Toilet
UKZN	University of KwaZulu-Natal
UNDP	United Nations Development Programme
UNFCCC	United Nations Framework Convention on Climate Change
UNHCR	United Nations Commissioner for Refugees
UNICEF	United Nations Children's Fund
VIP	Ventilated Improved Pit
VUNA	Zulu name for harvesting (harvesting urine)
WASH	Water Sanitation and Hygiene
WHO	World Health Organisation
WC	Ward councillor

Definition of terms

Acid mine drainage: refers to the outflow of acidic water from metal mines or coal mines.

Agricultural runoff: the portion of rainfall that runs over agricultural land and then into streams as surface water rather than being absorbed into ground water or evaporating.

Aquifers: An aquifer is an underground layer of water-bearing permeable rock, rock fractures or unconsolidated materials (gravel, sand, or silt) from which groundwater can be extracted using a water well.

Chronic water shortage: is the lack of sufficient available water resources to meet water needs within a region.

Climate Change: is a change in the statistical distribution of weather patterns when that change lasts for an extended period of time (i.e., decades to millions of years).

Decadal rainfall: is a robust, recurring pattern of ocean-atmosphere climate variability centered over the mid-latitude Pacific basin.

Freshwaters: Fresh water is naturally occurring water on Earth's surface in ice sheets, ice caps, glaciers, icebergs, bogs, ponds, lakes, rivers and streams, and underground as groundwater in aquifers and underground streams.

Hygienization: make clean by removing dirt, filth, or unwanted substances

Industrial Effluents: is any wastewater generated by an industrial activity.

Integrated environmental management: is a philosophy that is concerned with finding the right balance (sometimes called the 'golden mean') between development and the environment.

Triggering: Triggering is based on stimulating a collective sense of disgust and shame among community members as they confront the crude facts about mass open defaecation (OD) and its negative impacts on the entire community.

N-rich Mineral Fertilizers: A fertilizer (American English) or fertiliser (British English) is any material of natural or synthetic origin (other than liming materials) that is applied to soils or to plant tissues (usually leaves) to supply one or more plant nutrients essential to the growth of plants.

Natural resource base: its land, water, forests and trees are the foundation of any economic development, food security and other basic necessities of its people.

Wastewater: is any water that has been adversely affected in quality by anthropogenic influence. It can originate from a combination of domestic, industrial, commercial or agricultural activities, surface runoff or storm water, and from sewer inflow or infiltration.

Water stress: occurs when the demand for water exceeds the available amount during a certain period or when poor quality restricts its use.

Ward committee member: the community member that was elected by the community to work with the ward councillor to represent their needs on the ground and to support the ward councillor in the delivery of the community needs.

Ward councillors are the representatives of specific communities and are ideally placed to be the link between the people and the municipality – they should bring people’s needs and problems to the municipality and consult and inform the community around municipal services and programmes.

Abstract

Introduction

This study was part of the VUNA project which aimed to develop an affordable solution system that produces a valuable fertilizer, reduces pollution of water resources and promotes health. South Africa is one of the countries that is affected by water scarcity due to climate change, dwindling rain, rapid urbanization and the increasing population size. Due to the latter South Africa is looking at new affordable sanitation systems to not only save water but that will promote health like the UDDT. The eThekwin Municipality (EM) introduced the UDDT in its rural areas because it offers the latter and also allow for nutrient recovery from urine to be used as a fertiliser. The UDDT is a new technology and for the facility to be sustainable, social acceptance is vital, proper use and maintenance. A cross sectional study was undertaken, using mixed methods to explore the acceptance, use and maintenance of the UDDT. Key findings indicated that there was a low level of acceptance amongst users due to the poor communication and education, poor design of the toilet and aspirations to own a flush toilet. There is an urgent need for EM to address the misconceptions and the communication gaps through health and hygiene education so to improve the level of acceptance, use and maintenance of the toilet.

Aim

The study aimed to explore the acceptance, use and maintenance of the Urine Diversion Dry toilet (UDDT) and to use the findings to develop health and hygiene education.

Methods

Mixed methods were used: both quantitative and qualitative research approaches were used in this study in order to assess the condition of the UDDT and understand the target population's perceptions, attitudes and behaviour in relation to the UDDT in eThekwin KwaZulu-Natal. Initially a brief questionnaire was administered to assess the condition of the UDDT in 40 households in the three target areas, in total 120 households were visited. This was followed by twelve focus group discussions which were made of one family of the households visited. 25 in-depth interviews were conducted with community members who were actively involved in the roll-out of the UDDT's i.e. the ward councillor, the previous health and hygiene educators and ward committee members with community members. The data from the qualitative research were analysed through content analysis as emphasised by the theoretical framework that words create meaning.

Results

The results clearly indicated that although education was provided at the time of UDDT installation, the majority of respondents did not have comprehensive information in terms of how to operate and maintain the UDDT. The study also found that the majority of community

members had not accepted the UDDT as a permanent household asset. Eighty percent of UDDTs were in a bad condition. The study also found that in all areas very few households were not using the UDDT. Furthermore, the facilitators on the health and hygiene education programme reported that they had not been trained properly for this task. The findings also showed that community members were not aware of the water scarcity in the country and how this related to the introduction of the UDDT. There was also a high level of migration both out of and into the UDDT homestead areas.

Conclusion

The lack of proper training of the facilitators, inadequate sharing of information within the household and the migration of the original householders resulted in a lack of information within the household and community at large about the use and maintenance of the UDDT. This information gap largely contributed to community members' poor maintenance of their UDDT. This created negative attitudes towards the UDDTs since users felt that the toilet could not be kept in proper adequate sanitary conditions. It is crucial that communities are included as part of the sanitation provision process and are constantly informed and updated, in order to facilitate community adoption and ownership of the sanitation solutions being offered to them.

Recommendations

The information about the UDDT needs to be constantly and consistently shared with the households and community at large. The facilitators need to be properly trained on sanitation, health and hygiene, so that they can relay the information competently and effectively. New strategies need to be developed where communities participate in their own development. This process will allow communities to take ownership of their sanitation solutions and develop positive attitudes towards Urine Diversion Dry toilet (UDDT).

Chapter 1

1.1 Introduction:

South Africa (SA), like most developing countries, is faced with the challenge of inadequate sanitation (Tsinda et al. 2012). Lack of clean water and basic sanitation are a challenge to service delivery and to poverty alleviation and sustainable development (WHO/ UNICEF, 2006). According to the Joint Monitoring Program, approximately 2.5 billion people practice open defecation (WHO/UNICEF, 2012). The health impacts of inadequate sanitation can be serious, as evidenced by the estimated 1.5 million cases of diarrhoea and the 2001 cholera outbreak in KwaZulu-Natal (Mudzanani et al, 2003). Of those at risk, 75% live in rural communities, and this puts them at increased risk of diarrhoeal disease and helminth infections whereas access to sanitation can significantly reduce this morbidity, (Baker and Ensink, 2012). Approximately 1.2 billion people live in areas characterised by water scarcity and a further 1.6 billion live in conditions of water stress, with subsequent impacts on the achievement of environmental sustainability and eradication of extreme hunger (UN, 2006). In 2010, The World Health Organization (WHO) (2011) reported that worldwide the impact of diarrhoeal disease on children is greater than the impact of HIV/ AIDS, tuberculosis and malaria combined. Therefore, interventions to improve disposal of human excreta should also aim at preventing diarrhoea.

The Sustainable Developmental Goals (SDGs) Report launched in 2016 to be achieved by 2030 has 17 goals aimed at transforming our world has a specific goal on clean water and sanitation as it notes that by 2050, at least one in four people is likely to live in a country affected by chronic or recurring shortages of fresh water, (UN, 2016). The latter compels that we take action now in finding new ways to conserve clean water whilst providing people with the basic resources. The effects of poor sanitation on health, coupled with the impact that poor sanitation has on developing countries' economies, make sanitation a key pillar affecting economic and social development (WHO, 2003). The challenge of sanitation is experienced in many countries such as East Asia, Mexico, India and Sub-Saharan Africa (UNICEF, 2013). About 40% of the poorest households globally have not improved in terms of access to adequate sanitation (UN, 2011). At the current rate, it may take until 2049 to ensure that 77% of the world population has adequate sanitation (UN, 2011). The majority of the countries that will not meet their sanitation targets are in south Asia and sub-Saharan Africa, which includes South Africa (UN, 2011). This crisis is not only a climate problem but it needs multi-disciplinary efforts including governance and political will. The Democratic Alliance (DA) leader Mr Maimane said “we need to take urgent action to prevent this looming disaster” (BDLive, 2015).

In SA, 10 million people lack access to basic sanitation and the majority live in rural areas (SERI, 2011). According to the SA census (2012), 91% of people have access to improved water supply, 79% have access to improved sanitation, but access to the latter increased only from 71% to 79% between 1990 and 2010. It has been realised that conventional centralised

wastewater treatments, using drinking water to flush toilets, are environmentally unsustainable, present financial and environmental costs for governments, and alternative waste management options are required (Esrey, 2000). In spite of these efforts and the progress that South Africa and the rest of Africa have made so far, reports continue to show that Africa is lagging behind in terms of the attainment of some of the MDGs hence the launch of the Sustainable Development Goals (SDG's) to be achieved by 2030, President Jacob Zuma, 2016. The water and sanitation institutions in South Africa have had to be innovative to address the lack of sanitation, and urine diversion dry toilets (UDDT) are one of the latest innovations (SERI, 2011). However, significant problems remain concerning the financial sustainability of service providers, leading to a lack of attention to the maintenance of the sanitation solutions.

The eThekweni municipality (EM) is acknowledged as one of the municipalities in South Africa that is ahead in the provision of basic sanitation services (Buckley et al., 2008). Part of this acknowledgement emerges from how EM addressed the backlog it faced when the boundaries of the city were extended to become a metro, and the newly-included parts of eThekweni Metro were rural or peri-urban areas comprising approximately 75 000 houses; 80% of which had no appropriate water or sanitation facilities (Gounden et al., 2006). The eThekweni municipality selected the double vault UDDT as the preferred delivery instrument for communities that urgently needed sanitation, as their environment is suitable for dry sanitation (Buckley et al., 2008). This type of toilet operates without water and makes it suitable in the country where water is scarce (Buckley et al. 2008). It should be noted that the UDDT has been successfully used in countries such as China, Vietnam, Mexico, and Zimbabwe for decades (Austin and Van Vuuren, 2001). It is eThekweni Municipality's responsibility to provide effective sanitation for all its residents and to develop sustainable and environmentally friendly sanitation technologies. The UDDT was first installed in eThekweni in 2001 and to date more than 80 000 UDDT units have been built in the peri-urban and rural areas of eThekweni (Tilley et al., 2014). However, the first UDDT was first built in 1950 in Japan and further developed in 1960 in Vietnam as means of increasing safety in using excreta for agricultural purposes (Winblad and Herbert, 2004). The UDDT is used in countries like India, Ecuador, Namibia, Netherlands and The United States of America (Roma et al., 2011). Rieck et al., (2012) state that the UDDT was introduced in many countries to address a sanitation backlog, which is one of the reasons why eThekweni introduced this.

EM has connected 1.3 million additional people to piped water and provided 700,000 households with access to toilets in 14 years and it is the first municipality to provide 9kl free basic water monthly for the poor (eThekweni Municipality, 2013). The urgency to provide adequate sanitation to the new areas was further fuelled by a cholera epidemic which occurred in the province of KwaZulu-Natal from August 2000 to July 2001, with 105 389 registered cases and 219 documented deaths (Mudzanani et al., 2003). By March 2004, the official statistics of cholera cases in KZN as per the Cholera Database records, stood at 158 895 cases (Dept-KZN Health, 2000) It was noted that about 60% of the households in the areas affected by the cholera outbreak had inadequate sanitation and about 90% of the water connections in

these areas were not functional (Morris, 2001). For the implementation of the UDDTs, education is an integral part of the process in ensuring that the facility is accepted, properly used and maintained (Mkhize et al., 2014). Flores (2009) wrote that there was less experience associated with UDDT and therefore there was much to learn about them. As a result a number of surveys were conducted at eThekweni before and after the UDDTs were installed and these helped to improve on the toilet design, based on what users reported (Buckley et al., 2008).

The VUNA project is a collaboration between the Swiss Federal Institute of Aquatic Science and Technology (Eawag), eThekweni Water and Sanitation (EWS), the University of KwaZulu-Natal (UKZN), and the Swiss Federal Institutes of Technology in Zurich (ETHZ) and Lausanne (EPFL) (Etter *et al.* 2015). The project was multi-disciplinary in nature and this study was part of the social acceptance component aiming to promote acceptance, proper use and maintenance of the urine diversion dry toilet (UDDT). The project is vital for South Africa because it is a water-scarce country and this compels the country to initiate and develop adaptive mechanisms for water conservation and wastewater management. The main aim of the project was to promote sanitation and nutrient recovery through urine separation, many research studies were conducted under sub-headings namely: (a) Urine treatment processes (b) risks of using urine (c) social and economic aspects (d) Agriculture and urine collection networks. This study fell under the social and economic aspects since social acceptance is vital for the implementation of the UDDT because sanitation is only effective if the system not only provides a well-designed toilet and effective waste management, but also offers users a facility that caters to their needs and is sensitive to their cultural lifestyle.

The goal of the Water and Sanitation Unit of the municipality is to clear this sanitation backlog; therefore providing communities with UDDT toilets has a lot to do with correcting the past imbalances. The unserved areas are mainly rural communities of the municipality. EThekweni Municipality has taken a strategic decision to use (a) urine diversion dry toilets together with (b) health and hygiene education and (c) provision of 300 L water/household/day to reduce the sanitation backlog within the unserved areas. The UDDT was the preferred option because it does not just offer waste management, but has sustainable benefits for the environment (Gounden et al., 2006). It allows for the waste to be re-used for agricultural purposes (Buckley et al., 2008).

Lienert et al. (2003) state that the recovery of nutrients from human waste (urine and faeces) is feasible for the sustainable use of natural resources. However, Drangert (1998) argued that the recycling of human waste (both urine and faeces) is still stigmatized in contemporary societies. Urine reused directly or after storage has been reported to be a safe and a high quality alternative to the application of N-rich mineral fertilizer in plant production (Richert et al., 2010; WHO, 2006). The discourse upon which nutrient management is constructed is intrinsically linked to the appropriate use of the so called Ecological Sanitation (EcoSan) technologies (Roma et al., 2013). An EcoSan viewpoint sees human waste and wastewater as a resource. The implementation of environmental innovations requires a radical change in how

people think about the value of human waste, a vision which in turn challenges the traditional concepts of ‘flush and forget’ (Esrey and Andersson, 2001) and ‘drop and store’ concepts. The latter can be achieved if proper education is provided to relevant users within the context.

1.2 Rationale for the study and role of student

Mr Neil Macleod the previous Head of eThekweni Water and Sanitation when accepting the 2014 Stockholm Industry Water Award said: “we need to find new technologies that meet people’s expectations when it comes to sanitation”, (<http://www.sanews.gov.za>). It has been over a decade since the UDDTs were installed in the rural areas of KwaZulu-Natal, however Roma et al., (2013) report that there are still low levels of satisfaction with the facilities. Furthermore, there is less experience associated with UDDTs and information is required about their on-site performance, (Roma 2013). There is research currently underway (e.g. at the University of KwaZulu-Natal) to rigorously and systematically evaluate the UDDT. The eThekweni Municipality, as mentioned previously, has installed more than 82 000 UDDTs since 2001 in rural communities of KwaZulu-Natal (Roma et al., 2013). For sustainability, it is crucial that the users accept, use and maintain these toilets properly as a long term asset of the community. Holden and Austin (1999) emphasize that the social lifestyle and culture of the community must be uppermost when introducing a new technology, such as a UDDT, because it is personal, it is a different way of going to the toilet and most importantly this technology requires handling of faecal matter and urine to some degree. However, the success and sustainability of the UDDT relies on the users’ positive attitudes and how they behave towards these toilets.

The UDDTs were not only chosen for their cost-effectiveness, but also because of their environmentally friendly qualities (Gounden et al., 2006). Gounden et al., (2006) elaborates by saying one of the major motivations for choosing the UDDT over the ventilated improved pit (VIP) was the related to emptying pointing to the recent report that the municipality spent R700 million to empty 100 000 VIPs. Due to the hill terrain and inaccessibility of most VIPs it cost EM R600 to R1000 to empty one VIP. The latter is not sustainable. These qualities make them suitable for areas that are rocky and hilly. The UDDT is designed in such a way that it is odourless and the vaults are shallow to avoid contaminating ground water (GTZ, 2009). The latter will be achieved if the UDDT facility is accepted, used and maintained properly by the users. This includes offering relevant and comprehensive yet simple education to users before the toilet is introduced. Even after education has been provided users need the information to be refreshed and reminded, because the community composition often changes over time. McConville and Rosemarine (2012) assert that the toilet structure can be well designed and suitable for the environment, but it is useless if it not well received and properly maintained by the users. Toilets are only a part of the provision of good sanitation, and therefore it is necessary to understand all the factors that affect sanitation so as to break the cycle of disease (Mvula Trust, 2001).

There is a lack of literature on the social acceptance of the sanitation products. Gounden et al. (2006) states that EM has installed more than 82000 of UDDTs and therefore it was important to explore factors influencing their acceptance, use and maintenance in order for the project to be successful and sustainable. Health and hygiene education is one of the tools that have been used in many countries in implementing the UDDT or any sanitation technology to encourage acceptance, use and maintenance of the facility (Austin and Duncker, 2005).

The purpose of this research was to explore the acceptance, use and maintenance of the UDDT amongst users and subsequently to use the findings to develop a health and hygiene education programme that will be implemented in the community. An evaluation would be done thereafter to see if health and hygiene education had an effect on changing users' attitudes and behaviour towards the UDDT. The student worked as the principal investigator on this study, and had the responsibility to develop, design, monitor, modify and implement the study tools. The student also oversaw and monitored the execution of the study by the research assistants in order to ensure the dependability and credibility of the findings.

1.3 Aim

The study was undertaken to explore the current attitudes, perceptions and behaviour of users on the acceptance, use and maintenance of the UDDT and to develop health and hygiene education to improve acceptance, usage and maintenance of the UDDT.

1.3.1 Objectives

- a. To explore the factors that influence the use or non-use of UDDT.
- b. To investigate factors that encourage or discourage social acceptance of the UDDT.
- c. To explore the factors contributing to the maintenance and sustainability of the UDDT.
- d. To identify the methods used in the household and community to disseminate information about the UDDTs and to understand which techniques achieved the desired goal.
- e. To draw conclusions and make recommendations that will inform future community sanitation programmes.
- f. To develop health and hygiene education programmes based on the above.

1.4 Content of the thesis:

Chapter 1:

This introduces the overall research question concerning UDDTs, and makes an important case for this study. This section broadly discusses water and sanitation in South Africa and abroad. It also highlights the importance and benefits of having proper sanitation. This chapter also raises awareness about the negative implications of not having adequate water and sanitation. The reason for choosing this topic is discussed in terms of bridging the gap in relation to the provision of UDDTs in the rural areas of eThekweni. The aim and objectives of the study are presented.

Chapter 2:

This chapter elaborates and looks in depth at the issues related to water and more specifically sanitation. It explains why sanitation is important, discusses current realities in sanitation, particularly dry sanitation, and most importantly, considers the urine diversion dry toilet (UDDT). It interrogates what makes the UDDT relevant currently. This chapter also explores the role of health and hygiene education, as a programme, and how this should be implemented.

Chapter 3:

This chapter discusses the methodology employed in order to realise the study objectives. It identifies and explains the theoretical framework used to guide the study. The study used both quantitative and qualitative approaches (mixed methods). A rationale is provided for the use of both these approaches and how the study benefitted.

Chapter 4:

The findings of the study are presented. This section explores the results from both quantitative and qualitative data collection strategies.

Chapter 5:

The summary and conclusion of the study are presented and recommendations are provided.

Chapter 2: Background

2.1 The Challenge of lack of water and sanitation:

Scientists have estimated that by 2050 South Africa will experience a progressive decrease of (economically usable) freshwater resources, which will force the country to develop adaptive mechanisms for water conservation and wastewater management (Austin and Van Vuuren, 2001). At present many water resources are polluted by industrial effluents, domestic and commercial sewage, acid mine drainage, agricultural runoff and litter (DWAf, 2009a). South Africa is facing serious challenges in addressing water and sanitation, including the discrepancy between water supply and water demand, the theft of water resources, a deteriorating infrastructure, and the loss of essential skills, a strangling educational pipeline, management failure, and deterioration in the quality of water (Mvula Trust, 2011). These are all potential threats and key concerns. In the developing world, the lack of water and sanitation infrastructure constricts economic growth where such growth is needed most (DWAf, 2006b). A water resource is an essential asset, and managing it effectively is important since it impacts on a) economy, business and industry, b) farms and factories, and c) individuals and communities (Pollock et al., 2008). The water and sanitation challenge not only impacts on the latter, but also on health outcomes, where adequate access can fundamentally reduce infant and child mortality rates (von Munch 2005; Murray et al., 2011). It is crucial that these concerns are addressed, because if not, they put the health of the community and that of the environment in extreme danger (WHO/UNICEF, 2010).

South Africa is fast approaching a water crisis of disastrous proportions and the country is the thirtieth driest in the world (ENCA, 2015). South Africa, with other Sub-Saharan countries, is classified as a water-stressed country, with a yearly per capita availability of between 1 100 and 1 700 m³ of freshwater (UNEP, 2008). The burden of low rainfall is exacerbated by poor maintenance, aging infrastructure and an intermittent energy supply (ENCA, 2015). Currently, South Africa is one of the countries that is heavily hit by water scarcity due to dwindling rains and the rapid population growth (Blignaut and van Heerden, 2008). On average, 59% of households in South Africa use toilets connected to the municipal sewer and another 2.7% use flush toilets connected to a septic tank (Ndinda et al., 2013). Whites and Indians have the greatest access to flush toilets connected to the municipal sewer and Africans constitute the majority among the households that use chemical/pit latrines (CSIR, 2010). Clearly the growing demand for water compared to the supply constraints is leading to an untenable situation, and implies that profound efforts at redistribution of water have to be considered, amid water conservation strategies (Blignaut and van Heerden, 2008).

Irrigated agriculture, consuming 62%, is by far the single largest surface water user, with agriculture and forestry consuming a combined 65% of the total available water resource (SSA, 2006). The volume of surplus water available for utilisation of any kind is therefore declining

rapidly, implying that water is becoming a very scarce resource (a limiting factor to development) as eloquently articulated by Scholes (2001) in the following words, “*The availability of water of acceptable quality is predicted to be the single greatest and most urgent development constraint facing South Africa. Virtually all the surface waters are already committed for use, and water is imported from neighbouring countries. Groundwater resources are quite limited; maintaining their quality and using them sustainably is a key issue.*” Hence sanitation is an area that can play a huge role in saving water, by designing products that use less or no water at all. WHO (2012a) reports that poor sanitation also affects performance of girls in school due to increased absence, especially during the time of menstruation.

2.2 Commitment of the South African government

South African legislation (DWAF, 2001) set the ambitious goal to provide access to basic sanitation facilities to all South Africans by 2014, under the slogan ‘sanitation is dignity’ (Eales, 2008). South Africa has a constitution that guarantees the right to water in the Bill of Rights, but this right is still not enjoyed by millions of the country’s residents (Bill of Rights, 2011). Access to sanitation is a basic human need and although millions of people still lack basic sanitation, the United Nations (UN) in 2003 adopted it as one of the MDG’s (UN, 2011). The MDG target was to halve the proportion of people who do not have access to basic sanitation by 2015 (UN, 2003).

According to the World Health Organization (WHO) (2012a), ‘Sanitation generally refers to the provision of facilities and services for the safe disposal of human urine and faeces’. According to the 2011 United Nations (UN) MDG Report, 2.6 billion people globally lack access to adequate sanitation (UN, 2011). One of South Africa’s development priorities is the provision of safe water and proper sanitation (DWAF, 2012). The Minister of Water and Sanitation Ms Nomvula Nkonyeni in her 2015 speech argued that South Africans should be provided with a sanitation facility that will give them the dignity they deserve (Sanitation Indaba, 2015). Sanitation is a basic human requirement and the main purpose is to remove human waste from human settlements in order to prevent disease (WHO, 2006). Developing countries continue to need improved access to sanitation and its benefits (WHO, 2004). WHO demonstrated that poor sanitary conditions and practices caused 85 to 90% of diarrhoeal diseases in developing countries (Pruss-Ustun et al. 2004). Developing countries are characterized by poor sewer networks and water stress conditions have been a prime focus of technological development of ecological sanitation to increase coverage (Morgan, 2004). As there is a move towards different models of natural resources’ management, a shift from wet to dry sanitation technologies and from disposal of waste to nutrient and energy recovery, there is a need to understand the human dimensions of environmental and nutrient management solutions, including the relationship between the individual and human waste (Jeffrey and Jefferson, 2003).

2.3 The impact of climate change:

South Africa is a water-limited country with changing water-management structures and priorities (DWAF, 2009b). In South Africa's generally arid to semi-arid climate, less than 9% of annual rainfall ends up in rivers, and only about 5% recharges groundwater in aquifers (Bugan et al., 2012). It is situated in a region with increasing levels of water scarcity and water-quality problems, compounded by population growth and issues of social and economic development (Urama and Ozor, 2010). South Africa is a country classified as having chronic water shortages, a condition exacerbated by climate change and the presence of invasive alien plant species. Water supply in South Africa, however, is limited, unevenly distributed, and negatively impacted by changes in climate (Blignaut et al., 2009). Climate change is driven by changes in the atmospheric concentrations of greenhouse gases and aerosols. These gases affect the absorption, scattering and emission of radiation within the atmosphere and the earth's surface, thus resulting in changes in the energy balance (Denis and Denis, 2012). Since the mid-19th century, the earth has been moving towards a warm period (Denis and Denis, 2012). As the planet warms, rainfall patterns become erratic and extreme events such as droughts and floods become more frequent (Dennis and Dennis, 2012). Any climatic change could have adverse impacts on the water resources of a water-stressed country like South Africa. Climate change can affect groundwater levels, and recharge and groundwater contribution to base flow (Dennis and Dennis, 2012). Despite its relatively small contribution to bulk water supply, more than 60% of South Africa's population is dependent on groundwater (Braune and Xu, 2008).

Predicted climatic changes for South Africa include a general warming, across the country, of higher average temperatures in sub-humid areas (Tadross and Johnston, 2012). Mukheibir (2008) suggests that the temperature is expected to increase by approximately 1.5°C along the coast and 2°C to 3°C inland of the coastal mountains by 2050. Projected impacts are as a result of changes in rainfall and evaporation rates, and are also influenced by climate drivers such as wind speed and air temperature as well as soils, geology, land cover and topography across South African water catchments (Pegram et al., 2013). This, therefore, suggests that this challenge cannot be addressed by one sector independently, but all relevant disciplines need to be involved in managing this chronic water scarcity in South Africa.

2.4 Urine diversion dry toilet as eThekweni municipality's choice

The implementation of dry sanitation in eThekweni municipality can be traced back to the beginning of 2001, when the municipal boundaries expanded from 1 366 to 2 297 km², encapsulating a total population of 3.5 million, Roma et al., (2011), which 80% had no appropriate water or sanitation facilities (Gounden et al., 2006). The urgency to provide adequate sanitation to the new areas was further fuelled by a cholera epidemic which occurred in the province of KwaZulu-Natal from August 2000 to July 2001, with 105 389 registered cases and 219 documented deaths (Mudzanani et al., 2003). This incident and the consequences for the population's health focused the Government's attention on the need to -address the water and sanitation backlog as a matter of urgency, through the implementation of an integrated

water and sanitation project followed by hygiene education and training (Roma et al., 2010). UDDTs can be successfully used in all climatic conditions and are most advantageous in arid climates where water is scarce and faeces can be effectively dried (Tilley et al., 2014). DWAF (1994) report that there is no blanket solution to the sanitation challenge that can be applied universally, and that each region needs to find a sanitation technology that is suitable for its environment. The primary application for EcoSan systems has been in rural areas where connection to a sanitary sewer system is not possible, or where water supplies are very limited. The main objectives of EcoSan are: a) To reduce the health risks related to sanitation, contaminated water and waste, b) To prevent the pollution of surface and ground water, and c) To reuse nutrients or energy contained within wastes. Unfortunately, pit latrines can contaminate groundwater supplies, often smell bad, serve as breeding ground for disease vectors, and are impractical in rocky and sandy places, especially those with a high groundwater table, and those with insufficient space for burying pit contents or building replacement pit latrines (Jacks et al., 1999). UDDTs are waterless systems that are particularly suitable for conditions where water is scarce or expensive and recyclability is also a huge advantage of UDDTs (Tilley et al., 2014).

EThekweni Municipality is in the province of KwaZulu-Natal and in this province alone an estimated 1 million people have been impacted by water shortages and water restrictions, while some have to walk tens of kilometres to source drinking water (Stats SA, 2012). The effect of water scarcity was evident in 2015 in KwaZulu-Natal (KZN) where dams were only 35% full on average, to the extent where water restrictions were imposed by the municipalities in order to contain the drastic effects of the prevailing drought (COGTA, 2015). Flush and discharge options (sewer, wastewater treatment, drinking water treatment) are a heavy financial burden (WHO/UNICEF, 2014). Even in developed countries, these conventional systems are directly cross subsidised and their chances to ever become financially sustainable are low (Hauff and Lens, 2001). EcoSan is an alternative approach to circumvent the disadvantages of conventional wastewater systems (Werner et al., 2004). EcoSan is based on three principles, which are a) to prevent pollution rather than attempting to control pollution, b) rendering the urine and faeces safe for reuse, and c) using the safe products for agricultural purposes (UNICEF, 2013). EcoSan systems have to be i) affordable, ii) acceptable, iii) aesthetically inoffensive and consistent with cultural and social values, iv) simple and robust in design and operation, and v) as comfortable as conventional systems (Langergraber and Muellegger, 2004). Human excreta and water from households are recognised as a resource (not as a waste), which should be made available for re-use. According to Werner et al. (2004), the benefits of EcoSan are:

- Reducing the health risks related to sanitation, contaminated water,
- Preventing the pollution of surface and groundwater,
- Preventing the degradation of soil fertility and
- Optimising the management of nutrients and water resources.

- Additionally EcoSan systems have to return nutrients to the soil, and conserve valuable water resources.

EcoSan is not just a poor man's solution. South Africa, including eThekweni Municipality, is under immense pressure to conserve water, and therefore innovative strategies had to be employed in choosing the type of sanitation that would be suitable for areas that were lacking adequate sanitation, the majority of which were rural areas (SERI, 2011). Moreover, the climate condition in South Africa begs for re-conceptualisation of sanitation, from the 'flush and forget' model to protection of the environment at source (Drangert, 1998; Austin and Van Vuuren, 2001) by means of 'drop and reuse' models.

Dry sanitation in the form of the urine diversion dry toilet (UDDT) was introduced in 1997 and in 2002 the UDDTs were implemented initially as a pilot project in Umzinyathi (Gounden et al., 2006). According to Kvarnström et al. (2006), the UDDT is a system solution of great potential. In this pilot various types of UDDT designs were explored and finally a double vault UDDT was chosen. The present day double-vault UDDTs are based on the Vietnamese design which was developed in 1960, (Winblad et al. 2004). With double-vault UDDTs, faecal matter is collected and stored in twin-pit compartments, which are used alternately. When one vault is full (which should take roughly one year), the respective compartment is sealed while the other compartment is put in use. It takes at least one year for one vault to be full and it takes another year for the faecal matter to dry (Tilley et al., 2014). Gounden et al. (2006) explains that the decision to opt for the UDDT was because of cost considerations and environmental impact compared to the Ventilated Improved Pit (VIP) that the targeted communities were using. The UDDT toilet is a sealed unit so the groundwater is not impacted (Gounden et al., 2006). UDDT technology is based on the assumption that keeping urine and faeces separate, destroys the disease-causing pathogens contained in the faecal matter over time, through a drying process (Tilley et al., 2014). From the municipal perspective one reason for choosing the UDDT rather than VIPs is that VIPs demand mechanical desludging which requires expensive equipment that is vulnerable to failure, often cannot access the site and frequently cannot cope with the heavy sludge and solid matter found in the pit (WIN-SA, 2006).

DWAF (2006c) advise that a sanitation technology needs to be carefully chosen, based on the permanence of the settlement, the technical aspects, financial costs, design, expectations and environmental considerations. The latter is the reason that in 2011, the "Reinvent the Toilet Challenge" was initiated, to bring sustainable sanitation solutions to the 2.5 billion people worldwide who do not have access to safe, affordable sanitation (Bill and Melinda Gates Foundation, 2011). EThekweni Municipality is tackling the challenge of providing sanitation and water to its rural and peri-urban communities through the provision of urine diversion dry toilets (WIN-SA, 2006).

2.5 The findings from UDDT surveys between 2002 and 2008

Since 2002 there were two published follow up surveys that were commissioned by eThekweni Water and Sanitation under eThekweni Municipality to understand the reception of the UDDT in the community, as this was a new technology which the community needed to be accustomed to, (in terms of how it used and maintained) and change their perspective about the toilet, (Roma et al., 2011) Kvalsvig and Ngcoya 2006 and Lutchminarayan, 2007 are two of the published evaluations that were commissioned by eThekweni Municipality to find out the level of acceptance, use and maintenance of the UDDT. The findings from these surveys indicated that the level of acceptance was very low despite the education that was provided together with the installation of this toilet (Kvalsvig and Ngcoya, 2006). However in the survey conducted by Lutchminarayan, (2007) indicates the importance of health and hygiene education in the roll-out of the UDDT's as it found that areas that were offered health and hygiene education had cleaner UDDT's compared to those not provided with education. Moreover, Flores, et al., (2009) study showed that the Ventilated Improved Pit (VIP) and the UDDT share many similarities but the UDDT has most advantages to benefit not only the users but the environment as well. Drangert (1998) argues that patience is necessary as it takes a while for a community to change their perceptions about how to use the toilet. Numerous follow up surveys were done by consultants on behalf of eThekweni Municipality to investigate if UDDT users have accepted the new technology, and how they are using and maintaining it (Roma et al., 2013).

2.6 Community participation:

Toan, (2012) states that the people need to be at the core of the decision making process, because there is nothing that can be achieved effectively without the participation of the people who are to benefit from the process. It should be acknowledged that the community as the beneficiary is the main stakeholder throughout the process (CSIR, 2001). Community participation connotes the involvement of local resources and people in the provision of sanitation (Toan, 2012). Several authors have reiterated that it is wise to first establish what the needs of the community are and whether the fertiliser is a benefit and then to design the toilet according to the findings (UNESCO, 2006; SuSanA, 2008; Murray, 2009). Hence, UNICEF, (2003) states that women and girls need to take key roles because they are conventionally responsible for maintaining water quality and hygienic sanitation within the household. Both these ideas highlight the need for new approaches and technologies that support alternative sanitation efforts (Austin et al., 2005). Fox et al., (2013) advise that for a successful sanitation project towards achieving the intended purpose, the following need to be strictly followed:

1. Secure political commitment where politicians regard this a priority (Fox et al., (2013).
2. Create an enabling environment at national level where national authorities should create the policy, legal, regulatory, institutional and financial frameworks to support the delivery of

services at the municipal level in a transparent, participatory and decentralized manner, (Fox et al., (2013).

3. A holistic approach to water supply and sanitation should be adopted. This incorporates not only the provision of household services, but various other components of water resource management, including protection of the resource that provides the water, wastewater collection, treatment, reuse and reallocation to the natural environment, (Fox et al., (2013).

4. Addressing the environmental dimensions mitigates direct and indirect impacts on human and ecosystem health (Fox et al., 2013).

5. Adopt a long-term perspective, taking action step-by-step, starting immediately. A step-by-step approach allows for the implementation of feasible, tailor-made and cost-effective measures that will help to reach long term management objectives, (Fox et al., (2013).

The White Paper on Local government act 1998, is tasked with ensuring growth and development of communities in a manner that enhances community participation and accountability. It urges local Municipalities to work with communities as partners. Ward councilors are elected solely to link the local communities with government, hence one of the roles of ward councilors is to in touch with these changes and the needs of residents. In addition, councillors have to keep residents informed about decisions taken by council. The local government act 1998 stipulates the methods for (1) consultation, (2) reporting back to people and (3) for involving people that assist local leaders to achieve the former and the latter, namely

(1) To hold community meetings, door-door surveys, suggestion boxes and public hearing

(2) Sectorial meetings, ward/ public meetings, newsletters, newspapers community radio, community notice boards, advertisements and posters.

(3) Meetings with affected community or relevant sectoral groups like religious, welfare, cultural, business, etc. Well publicised community meetings, appeals through radio and newspapers.

The above plan is necessary at all times and especially when introducing a facility like urine diversion dry toilets that requires a lot of responsibility from the user. Roma et al., (2013) states that the latter can only be possible after vigorous community participation and education in order to gain adherence to the system (Roma et al., 2013). DWAF, (1994) concurs with the latter as it states that development experience world-wide has demonstrated that women play a fundamental role in the provision and maintenance of basic services. DWAF, (2001) says that community participation in the provision of sanitation is a key guiding principle, particularly in the promotion of health and hygienic practices. Integrated environmental management is a key guiding principle in sanitation provision. DWAF (2006b) asserts that municipalities need to ensure that the approach adopted for sanitation projects is in a manner that enhances community participation, ownership, skills development and job creation. The latter contributes to the sustainability and longevity of the facilities. All relevant stakeholders need to be involved, as far as possible, throughout the planning and implementation phases, in order

to ensure that the sanitation system is contextually suitable, and is not simply restricted to just the supply of toilets (NSP, 1996). Sanitation in the past has been seen mainly as a technical matter that is limited to building toilets, and providing and maintaining the sewer systems; whilst other aspects including economic and social factors have been given less consideration (NSP, 1996). However, it has been acknowledged that other factors are just as important in providing good and comprehensive sanitation (NSP, 1996). Good sanitation requires the community to be part of the decision making and to participate in creating a safe living environment (DWAF 2001). The citizens of South Africa are privileged in the world to have a constitution that preserves a basic right to receive sufficient water, stating that, “Everyone has the right to have access to sufficient food and water.” (Constitution of SA, 1996). The Socio-Economic Rights Institute of South Africa (SERI, 2011) advises that governments need to have a variety of sanitation technologies from which to choose, because the needs and challenges may vary with each community.

The Local Government Act (Part 2, section 10), 2002 states that local authorities are able to provide community governance at the local level and make a significant contribution to social, economic, environmental and cultural well-being. Community-based (rather than contractor-based) approaches that focus on sanitation improvement for people are encouraged by government, community-based approaches are more likely to ensure long-lasting benefits with significant positive implications for community health and local economic development (Eales, 2002). Community-managed projects have been shown to be more sustainable, because projects reflect local priorities and preferences, and result in a greater sense of ownership (City of Cape Town Report, 2008). Key stakeholders in the provision of sanitation are households, communities, contractors, local government, provincial and national governments, private sector and non-governmental organisations (DWAF, 2001).

Community participation is a process of partnership and sharing in decision making between communities and relevant stakeholders, such as government; it is not a vehicle to make people do what others want (eThekweni Municipality, 2006). Without proper consultation, users may not buy into the UDDT if they are not fully engaged in the project from the conception phase throughout the implementation process - including consultation, consensus and participation. The intention of local government was to work with local communities to find sustainable ways to meet their needs and improve their quality of life, through meaningful participation (COGTA, 1998). The Mvula Trust (2000) emphasizes that providing communities with a choice is an important first step towards building a sense of ownership, acceptance and pride in the product of choice.

2.7 Profile of eThekweni municipality rural areas

The eThekweni Municipality (EM) is responsible for providing water and wastewater services to over 3.8 million people in the City of Durban on the eastern coast of South Africa, as well

as to the surrounding wider metropolitan areas consisting of urban, peri-urban, and rural settings (DWAF, 2002). By early 1995, 95% of Durban was covered by a sewerage network (eThekweni Municipality, 2013); small urban sections of the surrounding areas were also covered.



Figure 1: Map of eThekweni Municipality
(Source: eThekweni Corporate GIS Department)

EM is situated in the province of KwaZulu-Natal, which is one of the nine South African provinces. EThekweni is one of the 11 districts of the KwaZulu-Natal province. The eThekweni Municipality spans over 2297km², of which 36% is rural and a further 29% is peri-urban (Dray et al., 2006; South African Cities Network, 2004). The municipal area stretches from Umkomaas in the south, including some tribal areas in Umbumbulu, to Tongaat in the north, moving inland to Ndwedwe, and ends at Cato Ridge in the west. It is largely defined by its geo-spatial features such as hilly, rugged terrain, dispersed settlement patterns in traditional dwellings, and communal land holding under the Ngonyama Trust (eThekweni Municipality, 2013).

The area is also characterized by severe poverty and unemployment with many households reliant on localized social assets such as community networks and organizations (eThekweni Municipality, 2013). Another challenge is the environmental vulnerability of the area, due to

heavy reliance by households on the natural resource base (eThekweni Municipality, 2013). The situation is exacerbated by fragmented service delivery, unresolved land tenure, a shortage of substantive information, and a legacy of lack of planning, (Njokweni, 2011).

The city's vision is that "By 2020, eThekweni Municipality will be Africa's most caring and liveable city" (eThekweni Municipality, 2006). The majority of its 3,090,126 people (now estimated at 3, 8 million as indicated previously) speak Zulu (Census, 2001). It was formed from seven formerly independent local councils and tribal land. The municipal council consists of 219 members elected by mixed-member proportional representation (Independent Electoral Commission, 2016). One hundred and ten councillors are elected by first-past-the-post voting in each of 110 wards.

2.8 Water in South Africa:

Water is indispensable for life. It is also indispensable for economic activities. South Africa's water and sanitation backlog is undoubtedly related to its historical development and the neglect of formerly Black urban and rural areas since the colonial and Apartheid eras (Chaplin, 2004; Penner, 2010). On average the country loses 37% of revenue from water due to physical leakage, commercial losses and any unbilled consumption (McKenzie, 2012). In many irrigation and municipal water supply schemes, this figure can reach as high as 60% (DWAf, 2008). In 2015 South Africa faced one of the worst years in water shortages since the previous drought in 1992, where the dam levels fell by 12 percent, (eThekweni Municipality, 2016).

The October Household Survey in 1995 reported that only 20% of Black people reported to having tap water inside their home compared to 100% of white and Indian households (Orkin, 1998). Access to an improved water source refers to the percentage of the population with reasonable access to an adequate amount of water from an improved source, such as a household connection, public standpipe, borehole, protected well or spring, and rainwater collection (The World Bank, 2006). Unimproved sources include vendors, tanker trucks, and unprotected wells and springs. Reasonable access is defined as the availability of at least 20 litres of water for a person a day from a source within one kilometre of the dwelling (Human Development Report, 2001). "Water is life" is the slogan used by EM to emphasize the importance of this resource to its residents since it is scarce and there is an urgent need to preserve it (eThekweni Municipality, 2015). The National Water Act, 1998 legislation has placed emphasis on water scarcity and the effective management of national resources coupled with the need to rectify historical inequities, and promote justice, and equality in the availability and use of water resources (The World Bank, 2005). The executive power to deliver water and sanitation services falls on local government, in terms of the Constitution (DWAf, 2006a). The main rivers are the Umgeni, Mbokodweni and Tugela Rivers, which drain to the Indian Ocean (DWAf, 2006c). Potential future water resources are seawater desalination and/or the transfer of water from the Zambezi River (UN, 2011).

In rural communities where fresh water is not readily available, the burden usually falls on the women to fetch water from available sources (UN Water, 2006). This means they have to walk long distances, carry heavy loads of water and risk the dangers of walking alone at night (UN Water, 2015). They also have the responsibility to preserve, store and manage their water supply. Women are excellent stewards of water as they know exactly the amount of water a basic household needs, where to find water and how to ensure that domestic water is safe and clean (UNICEF, 2003). If they are engaged in decision-making and implementation of water management programmes, they will be able to campaign for more and better located water collection points, and practical and attainable technology, such as pumps and containers to ease the collection of water (UNICEF, 2003). The women can also be assisted in ensuring that hygiene of the home is preserved using as little water as possible and one way is to install a tippy tap next to the toilet to ensure users wash hands every time after using the toilet. (UNICEF, 2008). The tippy taps are suitable for rural environments where water is not readily available and the other good thing about them is that it uses a foot lever to avoid bacteria transmission.

Outside of Durban, sanitation consisted mainly of open defecation (rural areas), simple pit latrines, and the “bucket system”, in which containers of human excreta were manually collected two to three times per week for emptying into designated dump sites connected to the sewage reticulation system (Flores et al., 2008). The evolution of the EM’s current sanitation program is closely tied to major events in the history of South Africa, particularly its transition from apartheid (DWAF, 2002).

2.9 Sanitation in South Africa

The concept of sanitation in SA extends beyond the notion of a toilet and recognizes the fundamental link between sanitation, health and hygiene (DWAF, 2001). Good sanitation includes a) appropriate health and hygiene awareness, b) behaviour change, and c) acceptable, affordable and sustainable sanitation services (DWAF, 2001). Analysts note that sanitation is not only important for health and well-being, but can also be a tool for economic development among the poor (Duse, 2003). The past 15 years have seen an evolution of techniques, methods and organizational structures that have impacted on environmental protection and sustainability (UN, 2008). Access to improved sanitation facilities refers to the percentage of the population with at least adequate access to excreta disposal facilities that can effectively prevent human, animal, and insect contact with the excreta (The World Bank, 2005). Improved facilities range from simple but protected pit latrines to flush toilets with a sewerage connection (The World Bank, 2006). Basic sanitation services’ is the safe removal of human waste and wastewater from the premises where this is appropriate, necessary, and accessible (Tissington, 2011). In 1995, the National Sanitation Task Team (NSTT) comprising of six government departments (i.e. Health, Education, Environmental Affairs and Tourism, Housing, Water Affairs and Forestry, Provincial and Local Government, and Public Works) established the Mvula Trust to

address the sanitation challenge, as this was identified as an area of priority (Moilwa & Wilkinson, 2004).

The UDDTs are provided by EM for free and DWAF (2009b) define free sanitation as a circumstance where consumers receive the service without making contributions in cash or any kind (DWAF, 2009b). A poor household is defined as a household ‘that does not have enough money/income to attain a minimum standard of living – enough to purchase a nutritionally adequate food supply and provide other essential requirements’ (DWAF, 2009a). The EM provides the UDDT for free and the household has to maintain it moving forward. Based on evidence presented both in this chapter and the previous one, alternatives to pit latrines and conventional sewerage and wastewater treatment plants are necessary.

In 1996, the Draft National Sanitation policy was developed with the purpose of improving the health and the quality of life of the whole population of the country. The policy’s viewpoint was that sanitation was far more than just the construction of toilets (National Sanitation Policy, 1996). Toilet building should be supported by promotional campaigns as well as health and hygiene education to encourage and assist people to improve their health and quality of life (National Sanitation Policy, 1996). The Cape High Court and the South African Human Rights Commission (SAHRC) have found that sanitation services (or the inadequacy thereof) violated the right to human dignity, privacy and the right to a clean environment (DWAF, 2012). In South Africa, the government has made important strides towards addressing both sanitation and water supply backlogs since 1994 (WSP/UNICEF, 2011). However there is still a long way to go, (UN, 2015). Hence the SDGs with The Sustainable Development Goals (SDGs), officially known as transforming our world: the 2030 Agenda for Sustainable Development is a set of seventeen aspirational "Global Goals" with 169 targets between them. The SGDS are designed to pick up from where the MDGs left off (UN, 2012).

2.10 Basic sanitation:

Tissington (2011) states that a basic sanitation facility is expected to meet policy requirements, as well as adhere to minimum design standards and norms that are applicable to all types of sanitation facilities provided. It therefore has to be a sanitation facility that is i) safe, ii) reliable, iii) environmentally sound, iv) easy to keep clean, v) provides privacy, vi) provides protection against the weather, vii) well ventilated, viii) keeps odour to a minimum, ix) the darkness prevents the entry and exit of flies and keeping flies out of the toilet minimise the chances of disease-carrying pests, x) enables safe and appropriate treatment and/or removal of human waste (as set out in the Strategic Framework for Water Services), and xi) accompanied by appropriate health and hygiene education (Water Services Act, 1997). Safe sanitation, which includes ventilated improved pit (VIP) toilets, ecological sanitation (such as urine diversion dry toilets), pour-flush and forget toilets, is about offering people dignity and health (WIN-SA, 2011). Without adequate sanitation, people (mostly children) suffer from increased incidence

of disease and death, women and children remain at risk of attacks, school days and work days are lost to the economy, and the environment is increasingly polluted with human waste (Van Vuuren, 2008).

2.11 Types of toilets:

The government of South Africa has explored a range of sanitation technologies including waterborne, the Ventilated Improved (VIP) toilet and EcoSan in the form of a urine diversion dry toilet (UDDT) (SSWM, 2014). Worldwide there are various types of toilets in terms of design, use and functionality, therefore people need to be offered a variety of toilets from which to choose, so the selection is one that is suitable for their environment, expectations and social norms (DWAF, 2006b). People should not be given sanitation technologies that conflict with their cultural beliefs and the toilet should require minimum effort from the user to maintain (WaterAid, 2011). The technology should be well designed, constructed to specifications using the correct materials, comply with policy requirements, norms and standards, and should have technical support for repairs and maintenance (Duncker, 2014). DWAF (2009a) states that what distinguishes a sanitation facility from a service, is the idea that the facility must be safe, reliable, private, protected from the weather, ventilated, keeps smells to the minimum, easy to keep clean and minimizes the risk of the spread of sanitation related diseases. The latter can be achieved by facilitating the appropriate control of disease carrying flies, pests, and enabling safe and appropriate treatment and/or removal of human waste and black or grey water in an environmentally sound manner (DWAF, 2009a).

The sanitation technologies that are commonly used in the world are (a) waterborne and (b) ventilated improved pit latrines (VIP) (Austin et al., 2005). These are often recognised as the logical solutions within limited budgets and therefore accepted as the minimum norm (Austin et al., 2005). The VIP is a suitable technology for rural and peri-urban communities, but its reputation has been damaged by the perception that it is a sanitation solution for poor people (Austin and Van Vuuren, 2001). Pit latrines follow the “drop and store” principle compared to open defecation that follows the “drop to forget”, and these are dominant in low income countries (Esrey & Anderson., 2001). The challenge with VIPs is the emptying, which is a costly and labour intensive exercise (Flores et al., 2008). Furthermore, a significant amount of space (2m x 2m x 1m) is required to make onsite burial of pit contents an option; ground conditions and lack of space often precluded this (Flores et al., 2009). From a construction perspective, the EM also recognized that VIPs had limited applicability in areas with rocky surfaces and high groundwater tables, since they require pit depths of 2 to 3 m (Tilley et al, 2014). Considering pit emptying access issues, this proportion dropped to 20%. Pit toilets have to be emptied when they are full, and the contents treated before being used for other purposes (WIN-SA, 2011).

The concept of EcoSan broadly encompasses various forms of nutrient management, from the simple planting of a tree over a full latrine to more sophisticated systems based on the separation of urine from faeces at source, which allows waste collection (Jackson, 2005). UDDTs are often called “EcoSan toilets” but this would wrongly label one particular toilet type as the only toilet to be used in EcoSan projects (von Münch, 2009). Due to the limitation of the VIPs discussed in this chapter, the EM decided that a dual pit Urine Diversion (UD) toilet was the best option for peri-urban/rural areas where there was at least 350m² of land available (including the land required for greywater management via evapotranspiration) (Gounden et al., 2006). The EM’s UDDT was designed with two ventilated 1m³ chambers and a moveable toilet seat (Gounden et al., 2006). When the active chamber is full, the pedestal is shifted and aligned with the empty chamber. The filled chamber is then closed and its contents allowed to dry and undergo hygienization while the other chamber fills (designed for approximately a 12 month period for a household of eight) (Flores et al., 2009). Once the second chamber is filled, the contents of the first chamber are removed and buried by the household (or a contractor); the freshly emptied chamber is now ready for use again (Flores et al., 2009).

The UDDT can be used indefinitely and completely managed at the household level, presenting significant advantages over the VIP (Flores et al., 2008). It can also be constructed where there are hydrogeological conditions unsuitable for VIPs. The main difference between the VIP and UDDT is the potential for nitrogen and phosphorus contamination of groundwater by the VIP, as it allows for storm water and wash water infiltration into the porous pit, which can mobilize contaminants (Flores et al., 2008). The design of the UDDT is being constantly improved based on the evaluation surveys (Buckley et al., 2008).

Water-borne sanitation as used in conventional sanitation systems is based on the collection and transport of wastewater via a sewer system, using (drinking) water as the transport medium (Lettinga et al., 2001). The latter is a luxury that South Africa can no longer afford to flush with this precious and increasingly scarce resource, namely water.

2.12 Sanitation and the environment

The pit toilet and open defaecation methods have a high potential to contaminate the environment by spreading pathogens, and that is the reason why pit latrines can only be built in places where they will not pollute wells or groundwater (Graham and Polizzotto, 2013). In developing countries, the simplicity and low cost of simple pit latrine construction, operation, and maintenance contribute to its widespread use (Flores et al., 2008). Unfortunately, pit latrines can contaminate groundwater supplies. Jacks et al., (1999) add that they i) often have a bad smell and serve as a breeding ground for disease vectors, and ii) are impractical in rocky and sandy places, places with a high groundwater table, and those with insufficient space for burying pit contents or building replacement pit latrines. The Ground Water Protocol needs to

be followed carefully to check if the ground is suitable for building UDDT to ensure that the water resources are protected and to avoid ground water contamination (National Water Act, 2003b). To avoid groundwater pollution the type of soil, the amount of moisture in the area, and the depth of the groundwater need to be considered. WIN-SA (2006) reported that it cost R600 to R1000 to empty one pit depending on the terrain and accessibility, hence eThekweni municipality chose UDDT over pit latrines.

2.12.1 Urine diversion dry toilet (UDDT):

The UDDT technology was originally promoted in connection with safe reuse of excreta (SSWM, 2014). However, the primary focus of UDDT implementation has gradually shifted from that of excreta reuse to the broader objective of creating an odourless, dry and versatile toilet that is applicable across a wide range of geographic and economic contexts (Rieck et al., 2012). UDDTs provide the following benefits in both rural and urban settings: (1) waterless operation, (2) no odour when correctly used and maintained, (3) treated faecal matter is dry, odourless and less offensive, (4) darkness ensure that the toilet does not attract flies or other vectors, (5) treated faecal matter is partially sanitised and safer to handle, (6) aboveground design or use of containers in below ground vaults makes emptying simple, (7) minimal risk of contamination of ground and surface water resources, (8) possibility of aboveground design facilitates construction in challenging environments and (9) possibility of construction in close proximity to or inside of the home adds security and convenience for users (Rieck et al., 2012). Additionally, although the UDDT can be built on different surfaces, it is crucial to involve experts to check the ground before building to avoid compromises in the structural integrity of the facilities (see Figure 2 below). UDDTs have been used in many sustainable sanitation projects worldwide, mainly in rural and peri-urban areas (SuSanA, 2011). However for the UDDT to be a success it needs to be operated and maintained properly and all of this responsibility is upon the user, Matsebe, 2011. In terms of operation the user need to ensure that they sit properly on the toilet so the urine will go to the front part of the seat and the faecal matter is at the centre of the seat, (Matsebe, 2011). Hence water or any form of liquid would not be used to clean the toilet, a damp cloth is allowed to clean the UDDT, (Gounden et al., 2006) This is important because the faecal matter need to stay dry so that it can dry and be re-used as the fertiliser. In a UDDT, the excreta inside the processing vault is dried with the help of natural evaporation and ventilation. Von Münch (2009) argues that UDDTs can be built with a single or double chamber for collection of faeces. By using a double-vault, handling of fresh excreta can be avoided, as the vaults are used alternately with sufficient time allowed for the faeces to sanitise (Tilley et al., 2014). Ventilation is generally recommended to prevent odour and flies and to enhance the drying process (Susana, 2008). The toilet requires no water for flushing. Absorbents such as lime, ash, or dry soil should be added to the chamber after each defaecation to absorb excess moisture, make the pile less compact and make it less unsightly for the next user. The addition of absorbents also reduces flies and eliminates bad odours (Buckley et al., 2008).



Figure 2: A collapsed pit latrine in Narok, Kenya, built on unstable sandy soil that could not withstand the rain events (photo: P. Mboya, 2009).

2.12.2 Benefit of the UDDT:

Several research studies and authors have reported that this sanitation system has applications in different contexts (rural, peri-urban and urban), provided that it is properly installed, operated and maintained (Kvarnström et al., 2006). Langergraber and Muellegger (2004) asserted that the UDDT was an EcoSan system that bridged the gap between sanitation and agriculture. This also played a major role in EM's decision to switch from VIPs to UDDTs. Human urine contains minerals such as nitrogen (N), phosphorus (P) and potassium (K) in a ratio of 11:1: 2, respectively (Roma et al., 2013). These minerals can be used as fertilizer and each year an average adult disposes of 0.36 kg of phosphorous and 5 kg of nitrogen from his/her urine (Roma et al., 2013). Urine reused directly or after storage has been reported to be a safe and high quality alternative to the application of N-rich mineral fertilizer in plant production (Richert et al., 2010; WHO, 2006). The UDDT is of benefit especially to a country like South Africa that has been declared a water scarce country, because it uses no water while a flush toilet uses 8 to 12 litres per flush, (Esrey 2000; Drangert, 2004; and Austin et al., 2005).

In the case of the UDDTs, faeces do not have contact with land for some time (approximately one year) before eventually being buried. During that period the faeces develop into a dry and odourless material (Rieck et al., 2012). This leads to an odour and insect free toilet which is appreciated by users, with contents which are simple to remove and it is safer to handle the faecal material once the toilet has filled up. The UDDTs could also be constructed at less cost than that of a VIP in any country (Rieck et al., 2012). Working in peri-urban and rural areas for example, demonstrating the benefits of sanitized urine and faeces in cultivation, the fertilizing value of the sanitized excreta had a positive effect in raising the sanitation demand among populations (Kvarnström et al., 2006).

2.12.3 Benefits of the UDDT

The urine diversion toilet is an importance sanitation technology from an MDG perspective as Tilley et al., (2014) state that a urine-diverting dry toilet (UDDT) is a simple, low-cost, on-site facility to contribute to the achievement of the MDGs. The provision of the UDDT would not only increase accessibility but it improves dry sanitation facilities by:

- a. reducing odours (Tilley et al. (2014)
- b. insect free (Rieck et al., 2012)
- c. simple removal of the faecal matter (Rieck et al., 2012)
- d. facilitating maintenance of the system (Tilley et al., (2014)
- e. contributing to improved health (Tilley et al., (2014)
- f. facilitating easier and more hygienic handling of the faeces (Rieck et al., (2012)
- g. reducing the risk of pathogen transport to groundwater (Rieck et al., (2012)
- h. facilitating nutrient cycling and creating possibilities of increasing food security (Buckley et al., 2008)
- i. urine diversion systems contribute less to environmental contamination than conventional sanitation systems, (Tilley et al., (2014)
- j. reduced risk of groundwater pollution for dry urine diversion systems(Tilley et al., 2014)

2.12.4 Challenge of the UDDT:

Roma et al., (2013) reported three most common challenges experienced by UDDT users since their installation. These were i) perception of smell from the toilets, ii) lack of privacy from doors not closing properly, and iii) the use of poor quality materials and workmanship for construction, and the urine pipe not properly connected.

2.12.5 Health and sanitation:

Borne et al., (2007) postulate that diarrhoea causing pathogens are mainly transmitted through the faecal-oral route. Toilets are only a part of the provision of good sanitation, but a complete understanding of all the factors that affect sanitation is required to break the cycle of disease (Mvula Trust, 2001). “Sanitation is a cornerstone of public health,” said WHO Director-General Dr Margaret Chan (WHO/UNICEF, 2008). “Improved sanitation contributes enormously to human health and well-being, especially for girls and women. We know that simple and achievable interventions can reduce the risk of contracting diarrhoeal disease by a third” (WHO/UNICEF, 2008). The absence of adequate sanitation has a serious impact on health and social development, especially for children (WHO/UNICEF, 2008). The ingestion

of faecal pathogens in contaminated food and water resources as well as faecal-oral transmission are the leading causes of disease and preventable death, especially in children under five years (Keusch et al., 2006). The UDDT contributes to break the cycle of diseases that spread when human excreta and waste are not properly managed (DWAF, 2002). Poor sanitation contributes to about 700,000 child deaths from diarrhoea each year (WHO/UNICEF, 2008). Chronic diarrhoea can hinder child development by impeding the absorption of essential nutrients and reducing the effectiveness of life-saving vaccines (WHO/UNICEF, 2008). Poor health has adverse effects on children's ability to learn and without education such children would not be able to break out of poverty (Harris et al., 2009).

Diarrhoeal disease has multiple transmission routes, and its control often requires multiple interventions. These include a) improvements in access to water and sanitation, b) better food and hand hygiene, c) good quality drinking water, and d) treatment (WHO, 2011). Once access to clean water and adequate sanitation facilities for all people can be secured, irrespective of the difference in their living conditions, a huge battle against many kinds of diseases will be won (WHO, 2004). South Africa's director of Communicable Disease Control, Ms Tsakani Furumele, said that improved sanitation, clean drinking water, chlorinated swimming pools, and a campaign to prevent people from using rivers was needed to prevent the spread of the disease (The Citizen Newspaper, 2014). Moreover, it has been reported in many parts of the world that one of the contributing factors to children's absenteeism from schools is the lack of clean water and sanitation, which also led to the spread of illnesses like diarrhoea (Jasper et al., 2012).

The 2.5 billion people worldwide that lack proper sanitation mostly resort to open defecation and this has detrimental effects on people's health and on the environment (WHO, 2015). Better sanitation also contributes to economic development, delivering up to \$5 in social and economic benefits for every \$1 invested through increased productivity, reduced healthcare costs, and prevention of illness, disability, and early death (WSP/ UNICEF, 2011).

2.12.6 Health and hygiene education:

The drive to improve health and hygiene education derives from the need to raise awareness in the community about the link between poor hygiene behaviours and disease (WaterAid, 2012). WHO (1997) states that health and hygiene education can only work when the community actively supports and was involved in all stages of the programme. Most countries in Africa and India where proper health and hygiene education was provided, proved to be a success because local people became aware of the importance of the water quality as it relates to health (UNICEF, 1998). It was also found that safe drinking water alone was not sufficient to ensure health. It has been reported that health and hygiene education also works better, if the programme is tailor made for each community in order to target behaviours and attitudes of that particular community (UNICEF, 1998). WHO (1997) reported that the common belief, among communities, was that children's faeces were harmless, whereas they were the main

source of infection among children. WHO (1997) recommends the education programme to include topics such as, water sources, water treatment, water storage, water collection, water drinking, water use, food handling, excreta disposal and wastewater disposal.

Health and hygiene education should be incorporated in the community, since hygiene behaviours are difficult to change and form part of people's culture and traditions (WHO, 1997). However, it is important that institutions like schools and relevant government departments, including the Department of Health (DOH), reinforce these messages in clear and simple language in order to not confuse people. Water and sanitation are fundamental to fighting disease and poverty (Morrison, 2009). Due to lack of knowledge, there is no ownership and no sense of responsibility regarding sanitation, especially at household level (Akter and Ali, 2014). One of the COP 17 resolutions was to develop and exchange educational and public awareness material on climate change and its effects (UNFCCC, 2011). Community training and refresher training on how to operate and maintain these sanitation technologies are vital (Duncker, 2014). Many users may be illiterate or very old, and may not be able internalise the message after only one training session on the use and maintenance of the toilet (Duncker, 2014). Refresher training is needed for users to internalise the content of the training session.

Many users are not proud of the sanitation technology they are provided with by the government, unless it is water-borne sanitation (Duncker, 2014). Having a flush toilet gives households status in their communities, especially in remote rural areas, which means that any sanitation technology that is not water-borne may be regarded as sub-standard (Duncker, 2014).

2.12.7 South African water and sanitation policy:

Since 1994 the South African government embarked on an ambitious program of eradicating backlogs in water supply and sanitation, underpinned by the development of sound sector policy and legislation (AMCOW report, 2011). A sanitation improvement programme should help people help themselves and government programmes must involve community members in local planning, organisation and implementation (DWAF, 2006b). The whole community should take part in some way, especially the women and children. People must be convinced of the need for sanitation improvements, in such a way that they will invest their own resources in those improvements and adopt good hygiene practices (National Sanitation Policy, 1996). Improved sanitation facilities will only achieve a parallel reduction in diarrhoeal diseases, if they are developed alongside hygiene programmes (National Sanitation Policy, 2006). Hygiene contributes to the prevention of the transmission of excreta-related diseases (Curtis et al., 2000). Most importantly, efforts to reach the Sustainable Developmental Goals (SDGs) must focus on sustainable service delivery, rather than construction of facilities alone. The Water Service Act (Act No. 108 of 1997), the principal policy regulating water service provision in South Africa, legitimises the right to basic sanitation as articulated in Section 3 that:

- ☐ Everyone has a right of access to basic water supply and basic sanitation;

- Every water services' institution must take reasonable measures to realise these rights; and
- Every water services' authority must, in its water services development plan, provide for measures to realise these rights.

The intake capacity and overloading of the natural environment with emissions and waste are reaching a critical point exacerbated by rapid urbanisation, increased population growth and migration into urban centres (United Nations, 2011). The effects are manifold, but the most affected are the poorest in society, especially women and children who suffer the most from water related diseases and the damaged environment in developing countries (WHO/ UNICEF, 2003). Although much has been achieved, significant challenges remain. There is a need to build and sustain capacity at the local government level, and to continue to invest in, operate, and maintain services. Furthermore there is a need to innovate and create more effective delivery pathways to reach the “hard to reach” places, and improve the sustainability of services already delivered (India Environment Portal, 2011). South Africa had its own ambitious service coverage targets of 100% coverage for both water supply and sanitation by 2014. There remains three areas of service backlogs that are “hard to reach”: i) sanitation in informal settlements, ii) water supply in deep rural areas, iii) and rural sanitation.

The goal of Government is thus to ensure that all South Africans have access to essential basic water supply and sanitation services at a cost which is affordable both to the household and to the country as a whole (DWAF, 2006b).

2.12.8 Operation and maintenance (O&M):

Flores et al., (2009) reported that the biggest challenges of the UDDTs were related to the education/training of the users on the proper operation and maintenance of UDDTs. The sustainability of the UDDT and its full benefits can only be realised, if it is operated and maintained properly, (Roma et al., 2011). However, most studies found that operation and maintenance was lacking due to lack of ownership and training (Susana, 2008). Langergraber & Müllegger, (2004) argued that operating the UDDT was relatively simple and had certain rules that needed to be adhered to routinely. If the UDDT is properly operated, it would need very minimal maintenance. Adherence to a regular O&M programme will keep the toilet clean, free of odour and flies, and urine pipes free of blockages (Rieck et al., 2012). All basic O&M tasks can be performed by the user, including the emptying of vaults and maintenance (Rieck et al., 2012). Ease of operation and inexpensive or no maintenance are key factors for the successful operation and maintenance of a toilet.

Availability of spares and the willingness or ability of households to pay for operation, maintenance and repairs are critical to the longevity of a sanitation facility (Roma et al., 2013). Institutional and technical support for maintenance and repairs are necessary. Users may not

know where to get spare parts nor how to repair the toilet, especially if they were not trained in the operation and maintenance of the toilet.

2.13 Sanitation reality in South Africa:

South Africans are accustomed to the conventional methods of ‘drop-and-store’ or ‘flush-and-forget’ systems (Drangert, 1998). The difficulty of adjusting one’s toilet habits to a UDDT should not be underestimated, and may be best approached with intuitive toilet designs and comprehensive user training programmes (Rieck et al., 2012). However, after many years of advocacy and increasing political willingness, sanitation remains one of the developing world’s most intractable challenges (WSP/ UNICEF, 2011). Sanitation remains poorly resourced and poorly understood, resulting at best, in limited progress (WSP/ UNICEF, 2011). To get back on track, roughly 200 million people per year need to begin using improved sanitation facilities (WHO, 2015). Provision of water and sanitation hold substantial benefits for public health, the economy and the environment (OECD, 2011). The problems caused by the decreasing quality and quantity of fresh water resources are increasingly becoming serious (UN Water, 2015). All indicators show that the world is facing a serious water crisis, which will affect everyone, particularly the poor (UNESCO, 2006). The poor suffer the most from this decrease in fresh water resources, and bear the brunt of water-related diseases and a damaged environment. People of South Africa are encouraged by the Government to have a garden at home to feed families due to poor food security (Department of Agriculture, 2002). Sanitation thus includes both the ‘software’ (understanding why health problems exist and what steps people can take to address these problems) and ‘hardware’ (toilets, sewers and hand-washing facilities). Together, they combine to break the cycle of diseases that spread when human excreta and waste are not properly managed (DWAF, 2002).

2.14 Food security:

Population growth, climatic changes and over-exploitation of natural resources are at the basis of the world’s food crisis, which accounts for almost one million people without sufficient food (Roma et al., 2013). Establishing food security, particularly household food security, is widely acknowledged as an important milestone in advancing the living standards of the rural poor (Abdu-Raheem & Worth, 2011). However, Heady and Fan (2008) state that some of the challenges to achieve this are the regular increase in oil and fuel prices which have a direct impact on food prices and the fertiliser. The UDDT plays a major role in mitigating this impact as one of its benefits allows for recycling of urine and faecal matter, both of which can later be used as fertiliser. This can lead to potentially lowering the price of the fertilizer. Lack of food security is a global crisis and as a result more than 814 million people in developing countries are undernourished, of which 204 million live in Sub-Saharan Africa (Labadarios et al., 2011). South Africa is plagued by poverty and unemployment despite the advances that have been made since 1994 (Labadarios et al., 2011). Food insecurity exists when food is not easily

accessible and households have difficulty securing adequate food (Labadarios et al., 2011). At least 50% of deaths among children in developing countries are attributable to malnutrition, where 10.4 million children under the age of five die every year (WHO, 2004). In the light of this, urine diversion and subsequent use of urine as fertiliser will increase the accessibility of fertilisers at reasonable prices. This will have a positive effect in the growing and distribution of food.

2.15 Recycling of waste:

Waste should be considered a resource, and its management should be holistic and form part of integrated water resources, nutrient flow and sanitation (Labuschagne, 2010). Development from this perspective should therefore contribute to increased food security, supporting environmental protection, empowering women, and reducing productivity losses due to morbidity and malnutrition. The climate-induced degradation of fresh water resources, more droughts and flooding, and a related decline in food production are already having an impact on many of UNHCR's operations in Asia, Africa and the Middle East (Urama & Ozor, 2010). The use of separately collected urine as a fertiliser after appropriate storage is strongly recommended, due to its high nutrient concentration and the low associated health risks (von Munch, 2009). The paradigm shift starts with the realisation that human excreta are not waste, but important resources for nutrients and energy in the form of organic substances (Niwagaba, 2007). However, there is a need to educate and train communities on health and hygiene as a prerequisite for human waste reuse which complies with WHO guidelines for sludge reuse in agriculture (WHO, 2006). Finally, where fertilisers and soil conditioners are unaffordable to the poor, it makes sense to recover organic matter and nutrients from human excreta in a safe manner, and conventional sanitation systems are generally not designed to do this. In KwaZulu-Natal 60% of the population lives in rural areas, where food shortage is a challenge (Altman et al., 2009). EM has a similar proportion of the population living in rural areas, and these technologies would therefore address real world challenges within the municipality (United Nations, 2011).

2.16 Migration in South Africa:

Migration is the most difficult to define and least understood component of population change (Statistics South Africa, 2013). Migration can either be viewed as internal or international. This study focuses on internal migration, where people move within South African borders from one rural community to another. **Circular migration** or repeat **migration** are temporary and usually repetitive movement of a migrant worker between home and host areas, typically for the purpose of employment. It represents an established pattern of population mobility, whether cross-country or rural-urban, (O'Neil, 2003). Internal migration has increased from 1994, since the segregation laws were lifted by the democratic government (Kok et al., 2003). Kok and Aliber (2005) state that one of the biggest challenges with internal migration is that it is not

easy to monitor and it makes it very difficult for government to plan. Amit et al. (2009) reported that between 2001 and 2007 74% of the population growth in Gauteng Province was due to natural growth (the difference between the birth and death rate of people already living in the province), only 26% was due to migration. Only 3% of the total growth was due to cross-border migration. Migration is mostly a result of urbanisation, where people move from rural areas to urban areas in search of a better live and to improve their quality of life (Wentzel and Tlabela, 2006). However, Tomlinson et al. (2006) and Cross (2005) argued that there were significant rural-rural movements, and census figures for the 1996-2001 period show movements into some predominantly rural district. The eviction of black people from the farms after 1994 and some that moved, by choice, to other farms with better working conditions largely contributed to rural –rural area migration (Kok et al., 2003)..

2.17 Provision of training material and education by EM:

The education provided about the UDDT was facilitated by local community members (as an income generating project for the community) and each household was visited up to five times to deal with different topics, depending on the phase of the project (WIN-SA, 2006). The topics that were covered before the toilet was installed were: (1) informing the household members of the plans of the EM and collecting demographic data of the household; (2) discussing the benefits and risks of the UDDT with the family; (3) learning how to operate and maintain a UDDT; (4) learning about the water system to be provided to the household (not for the toilet); and (5) handing over the UDDT and practically going through use of the facility with the household members.

The material had both Zulu and English versions, which catered for community language needs. The material included both text and pictures which helped to emphasise the messages that the text aimed to deliver.

In May 2011, the World Health Organization (WHO) and UNICEF convened a global stakeholder consultation in Berlin, hosted by the German Ministry of Economic Cooperation and Development (BMZ), to start the process of formulating proposed post-2015 WASH targets and corresponding indicators. The two-year consultative process, involving over 200 individuals and over 100 leading organizations in the sector, resulted in the development of proposed targets which were ambitious yet considered achievable by leaders in the field (UNICEF, 2013). The shared vision was that:

- No one practiced open defaecation
- Everyone had safe water, sanitation and hygiene at home
- All schools and health centres had water, sanitation and hygiene

- Water, sanitation and hygiene were sustainable and inequalities had been progressively eliminated.

These also played a role in influencing policy on water and sanitation.

2.18 User expectations and needs:

The current sanitation system mostly used in South African urban areas depended on water extensively through flush toilets (Matsebe, 2012). The author reported a great dissatisfaction amongst users of the UDDT mainly because of the design of the toilet. Drangert (2004) explained that the dissatisfaction emanated from the aspiration of users to have a flush toilet, which was perceived to be for first class citizens and the EcoSan system for the poor. Duncker et al. (2006) stated that the level of maintenance and operation of this type of EcoSan technology could reduce its acceptance. Therefore, the political will is also very important in the acceptance of the new technology by the general public. User interface is a key consideration for the success of a UDDT (McConville and Rosemarin, 2011). People's choice of a sanitation system is influenced by their feelings, perceptions of the sanitation system and its ability to satisfy those needs (Deet al., 2007). The role of this study, therefore, is important in the future plans and policy making (Duncker et al., 2006). Matsebe (2012) explained that these feelings and perceptions were greatly influenced by cultural beliefs and practices. This resulted in negative community attitudes towards the technology provided and, in some cases, the toilets were vandalised to prove that they were not culturally appropriate. Users may not understand nor be aware of context specific challenges and the, implementation costs and maintenance costs related to their choice of sanitation facilities. Free basic sanitation might mean, to some users, that all aspects of sanitation should be free, including maintenance and repairs, and should be provided by government (DWAF, 2006c). Most aspects of sanitation, besides cleaning the toilet, are not regarded as the responsibility of the household/owner (DWAF, 2002).

Some users may not be willing to pay for a toilet that they do not want. Everybody wants a flush toilet but many cannot afford this service (Duncker, 2014). Some might be able to pay for a toilet and for its operation and maintenance that is not a flush toilet, but still appropriate for their environment, but because it is not the toilet they wanted, they are not willing to pay. Many users may not be able to pay for a toilet because of the poverty levels in the country (Duncker, 2014). Hence the EM provide the UDDT to the users free of charge, however the household may still be too poor to buy cleaning materials for maintaining the toilet, or spare parts to repair the toilet. All of these expectations have a great influence on the acceptance of the product.

2.19 Acceptance of the UDDT:

Acceptance is an “act of accepting, or receiving what is offered, with approbation, satisfaction or acquiescence, especially, favourable reception, approval, as the acceptance of a gift, office, doctrine, etc.” (Websters Dictionary, undated). Sustainable sanitation facilities and their accessibility to people for sustainable lifestyles have become of critical importance in South Africa (Landman, 2004). Even if the technology is designed and built well, the use of the technology is the most important critical element - a technology is only as good as its user (Duncker and Matsebe, 2006). The use of the technology and its acceptance by the user were key factors that impacted on the sustainability of the technology. Research showed that many of the households that were provided with basic water and sanitation services had joined the backlog again due to the infrastructure not being used for the purpose it was intended to (Duncker et al., 2008). Like any technology, UDDTs are only an option if they are accepted by the users. The handling and use of dry faeces and separated urine may prove particularly difficult to accept by users in certain cultural or socio-economic settings (Rieck et al., 2012). User acceptance often depends on the perception of the status attached to the new facility (GTZ, 2009). Toilets generally compare favourably. If flush toilets are already established, UDDTs are often connected with lower status (Drangert, 2004). In such cases, education about the advantages of UDDTs may lead to acceptance. The education programme that was provided was precisely developed to address the benefits of the UDDT.

In situations where flush toilets connected to septic tanks or sewers are technically and economically feasible, UDDTs may be more difficult for users to accept, as they are often perceived to be inferior in status, comfort and hygiene (GTZ, 2009). In such situations, information on the beneficial aspects of dry systems and reuse is extremely important to change common perceptions (GTZ, 2009). The findings in the study that was done in EM indicates that, the long-term success of UDDTs depends largely on the proper operation and maintenance, intensive and long lasting information and awareness campaigns are essential when introducing UDDTs as a new sanitation technology (Buckley et al, 2008). Many sanitation projects, both conventional and alternative systems, have been implemented through subsidised top-down programmes and ultimately resulted in high construction costs, a lack of ownership, and neglect of facilities and poor scalability (Gounden, 2006).

2.20 Teaching methods:

The EM was using participatory hygiene and sanitation transformation (PHAST) method as a framework in designing it previous learning material (Gounden et al., 2006). PHAST seeks to help communities improve hygiene behaviours, reduce diarrhoeal disease and encourage effective community management of water and sanitation services (WSSCC 2009). It aims at empowering communities to improve hygiene behaviours, preventing diarrhoeal diseases, and encouraging community-management of water and sanitation facilities.

However, to improve on the education that was provided, it was crucial to explore other methods namely Community Led Total Sanitation (CLTS). CLTS is an innovative methodology for mobilising communities to completely eliminate open defecation (OD). Kar (2014) states that it is the power of collective community action that can transform the traditional thinking that improvement in sanitation was possible only when it was externally funded. The author continues to state that this method encourages communities to use the local resources to solve their sanitation challenges and discourages dependence to external people. At the heart of CLTS lies the recognition that merely providing toilets does not guarantee their use. Kar (2014) argued that governments wanted to move away from providing latrines to enhancing sustained behaviour change through developing human beings who would champion the cause of sanitation and empower and inspire the local communities. CLTS triggers the community's desire for collective change, propels people into action and encourages innovation, thus leading to greater ownership and sustainability (Institute of Development Studies (IDS), 2011)

CLTS typically evokes feelings of shame and disgust to move a community from defecating in the open to fixed-point defaecation and to improved sanitation (Perez et al., 2012). Consequently, CLTS can elicit strong emotions and may even shock communities that have become immune to traditional information, education, communication (IEC) approaches, which focus on more rational, less emotional messages (WSP/ UNICEF, 2011). Once a community has been ignited, CLTS uses additional positive messages to motivate communities to change and sustain good sanitation behaviours. All these approaches aimed to achieve open defaecation free (ODF) neighbourhoods, and how to get there remained a core function facing society (Lagardien et al., 2009). Triggering is based on "local people deciding together how to create a hygienic environment that benefits everyone." Triggering has been shown to create opportunities for community acceptance and ownership of sanitation, by mobilising community responsibility and collective action because everybody was affected (Ahmed, 2008).

The Water Sanitation and Hygiene (WASH) programme is fighting for all people to have access to water and sanitation and acquire proper hygiene behaviours through education, since this will help reduce illness and disease (WHO, 2011). WHO, UNICEF and USAID (2015) concur that WASH is a fundamental element of healthy communities and has a positive impact on nutrition and development. WASH typically refers to activities aimed at improving access to and use of safe drinking-water and sanitation, as well as promoting good hygiene practices (e.g. hand washing with soap at critical times). Many countries both developed and under-developed have adopted the WASH programme to help improve health and the quality of life amongst its citizens (WHO /UNICEF, 2012). All UNICEF WASH programmes were designed to contribute to the Millennium Development Goal for water and sanitation (WHO/ UNICEF, 2006). The goal - to cut in half, by 2015, the proportion of people without sustainable access to safe water - was achieved globally, but the same target for sanitation has been missed by almost 700 million people (The New Age, 2015). In Vietnam, as a multi-ethnic country, teacher

centred approaches to encourage hand washing with soap amongst school children in schools have been explored (Chase and Do Q, 2012). However, compliance was very low. Handwashing with soap (HWWS) is considered one of the most cost-effective means of preventing faecal oral transmitted diseases and other infections, especially in developing countries (Ejemot-Nwadiaro et al., 2008).

2.21 Social behaviour and culture:

Sanitation programming is as much about behavioural change as it is about public health engineering (Xuan and Hoat, 2013). Behaviour change is very much embedded in the social norms and belief systems of any society (WaterAid, 2011). The extent to which a community can change its way of doing things is limited by their strength of conviction about the good or harm of the practices (WaterAid, 2011). It is also limited by the social functions and beliefs surrounding them. The proper use of the toilet is also reliant on the perceptions people hold about that toilet, Stats SA (2014) states that in 2014 alone 84 065 consumer units were provided to people in South Africa and this bucket system remains a persistent phenomenon in all nine provinces. The recipients will not use the toilet or maintain the toilet properly if they view it as demeaning.

Social marketing is a process for creating, communicating, and delivering benefits that a target population desires in exchange for adopting a behaviour that profits society (WSP/ UNICEF, 2011). In any social marketing intervention, a specific behaviour is targeted for modification or adoption for the benefit of society as a whole. To improve rural sanitation, individuals and the community as a whole must stop the practice of open defaecation, acquire and use a hygienic sanitation facility, properly maintain sanitation facilities, and properly dispose of children's excreta (WSP/UNICEF, 2011).

The economic status of the people also plays a huge role in people's behaviour (Dijksterhuis et al, 2006). According to the MDG country Report (2013) 60% of the South African's government budget is allocated for social grants, and 60% of the children in the same year were offered free basic education. Social grants have become a source of livelihood in South Africa and they have played an instrumental role in reducing poverty levels (Statistics South Africa, 2014). According to the 20 year review released by the presidency approximately 2.8 million low cost houses have been provided since 1994 (The Presidency of South Africa, 2014).

2.22 Attitude and behaviour change

Attitude is defined as a feeling, belief, or opinion of approval or disapproval towards something and behaviour is an action or reaction that occurs in response to an event or internal (Donn & Baron, 1997). Attitude and behaviour determine people's lifestyle and therefore targeted

interventions that are part of people's lifestyle are of critical importance (WHO/ UNICEF, 2008). In order to change people's behaviour, changing the attitudes of people is important and needs to occur first (Duncker, 2014). The various theories concur that fear, threat, self-efficacy and response efficacy variables are essential to take into account when intending to change behaviour (The World Bank, 2006). People need to understand the benefits, the risks involved and the steps they need to take in order to change attitude or behaviour (Duncker et al., 2007).

2.23 Research gap:

The results of the survey done by Health Systems Trust (HST) (2015) showed that there was a low acceptance of the UDDTs and under-utilisation but there was a gap in the understanding of:

- (1) What could have been the reasons for people to develop such attitudes?
- (2) Whether the health and hygiene education rendered could improve people's acceptance, use and maintenance of the UD toilet?

The study also reported that there were households that were using other types of toilets and some households were changing their UDDTs to septic and flush toilets (Roma et al., 2013).

Therefore, this present study aimed at exploring the current attitudes, perceptions and behaviour of users on the acceptance, use and maintenance of the UDDT and use the latter findings to develop health and hygiene education to improve acceptance, usage and maintenance of the UDDT.

This study was important for EWS because every product that is introduced needs to be accepted, used and properly maintained for it to serve the intended purpose. The results of this study will help in understanding the factors involved in the acceptance, usage and maintenance of the UDDTs and also inform the modification of the EWS health and hygiene education.

2.24 Theoretical perspectives

Chinn and Kramer (2011) defined symbolic interactionism theory as an expression of knowledge; a creative and rigorous structuring of ideas that project a tentative, purposeful and systematic view of phenomena. The literature reviewed in this study provides a number of theoretical perspectives that help in contextualising UDDT as a sanitation solution that is new and requires a change of mind-set in how people use toilets. It also requires a lot of responsibility from the owner. Therefore, the symbolic interactionism theory was used to understand the factors influencing the acceptance, use and operation and maintenance of the UDDT and to use this information to develop an educational intervention.

2.25 Delivery of EM education prior to installation of the UDDT:

The health and hygiene education was first implemented in 2001 when the UDDTs were first introduced and the Institute for Social Development (ISD) was hired by the EM to supervise the roll out of toilets and the implementation of the health and hygiene education, (Buckley et al., 2008). According to Gounden et al., 2006 the EM followed a standard process in the delivering of the UDDT to the different communities, as the plan is illustrated below. The ward councillor working together with the ISD recruited local people to be trained on health and hygiene education. The ISD also had to train recruited local people on health and hygiene facilitation. According Gounden et al., (2006) the facilitators were paired and each day they had to visit five households; each household was to be visited five times because the content was divided into five sections. All households were to be visited, and the education provided. The latter and the former was the plan of the EM but there were challenges like the weather, terrain and poor monitoring that resulted in events not rolling out as planned. A plan had been developed for the education of householders who were to receive a UDDT. The education focused on the benefits of the UDDT and how this benefits the environment and the users. The education also looked broadly at the water scarcity and water conservation in relation to the UDDT, whilst engaging the participants psychologically and entrusting them with responsibility of conserving water for generations to come. The aim was to place the users in the household at the centre of the environment preservation.

Health and hygiene education had been provided by eThekweni Water and Sanitation (EWS) through the Institutional Social Development consultants (ISD) working with the local people as facilitators. The facilitators were recruited by ward councillors; the criteria were to get people who can read and write and who were above 18 years of age. The facilitators were recruited by ward councillors and their level of education was not a priority; some did not have matric (grade 12). The facilitators worked during week days from 8am to 15:30pm and at this time most people are at work and the children are at school. Therefore, in most cases facilitators reached elderly women alone in the house and they gave them the necessary information with the hope that they would cascade the information, to other family members. The plan below is illustrated by Gounden et al., 2006 as the standard guide that was followed in all areas where the UDDT was implemented.

The plan:

- At the first visit the community facilitators visited each household to brief the household on the plans to provide sanitation and water. Secondly, they collected data as to how many people are in the household and if there are any people who are physically challenged. This information helped the municipality to know how many toilets to provide for each

household and whether or not to build an access ramp. Households with more than eight members are provided with two toilets.

- The subject for the second visit was health and hygiene which targeted the household members. This session focused on the current reality of the toilets that the community and household are using, highlighted the risks, and looked at the benefits of having a UDDT and how proper sanitation can break the cycle of disease.
- The third visit focused on the UDDT as a facility and how it is operated and maintained, and the facilitators discussed the dos and don'ts, please see appendix N and O.

Do's:

- a. Faeces are deposited into the back of the toilet bowl and the ladies urinate into the front part
- b. Ash or sand is thrown over the faeces after each use. Do not pour water into the pit.
- c. Men and boys use the separate urinal
- d. Clean the urinal with fresh water. Do not use disinfectants.
- e. Keep the lid of the toilet closed to keep flies out of the pit.
- f. Always wash your hands after using the toilet.
- g. When the first chamber is full, move the toilet bowl and place it over the second hole and cover the first chamber.

Don'ts:

- a. Do not defecate into the front of the toilet
 - b. Males must not urinate into the back of the toilet, use separate urinal.
 - c. Do not throw rubbish into the pit
 - d. Do not let water get into the chamber that is drying.
- The fourth visit focussed on water, what water system would be provided, how much it will cost and how it is going to be supplied.
 - The fifth visit was when the facilitator hands over the facility, the family members are taken to the UDDT and shown practically how it is operated and maintained. The facilitator provided gloves, spade, rake and a bucket to the family. The facilitator also left an A3 poster with the relevant information in each household to be pasted at the back of the toilet door.
 - After the household received the training, EWS then provide a 200lt yard tank to all households that were outside the reach of waterborne sewage and could not afford to pay for water.
 - The eThekweni Municipality health promoters were available to continuously give post-education using the Participatory Hygiene and Sanitation Transformation (PHAST) approach. According to Gounden et al., 2006 the education informed by PHAST approach in a form of street theatre performances in public areas like schools, shopping centres and taxi ranks was to

be rendered until the correct usage of the toilet become entrenched but this did not go on for too long because of the cost-implications. This form of education is used to reinforce the educational messages only if and when the ward councillor has made the request.

The five visits were a great plan because it staggered the education so people will be given enough information at a time so as to absorb it and allow time to relay the information to the family members. The five visits were designed to be in line with process of the project as the fifth visit was to be given when the toilet has been installed, this session was to be practical and show users how it is to be operated and maintained. It would not work if the households were to be visited once because they will be overwhelmed with information which will make it difficult for them to absorb and implement.

2.25. 1 Challenges of programme implementation

There were a number of challenges experienced with the implementation of this EWS? programme. This section highlights these challenges.

There were areas in the communities that had households with children under the age of 5 years that were provided with toilet seats for children. However, this was not done in all the areas. This created a non-uniform implementation of the programme in this aspect.

The influential people and leaders in the community converted their UDDTs to flush toilets. However, this was not encouraged by the policy as the infrastructure was not in place to support this conversion. This made it difficult for the community as a whole to adopt positive attitudes about the intervention and accept the sanitation solution. The leaders were not leading by example.



Figure 3: a and b UDDT converted to flush

The ward councillors and the local people who are well-off were reported to change the toilet from UDDT to flush (see Figure 3a and b) and this also emphasized people's perceptions that the UDDT is for the poor. There was conflict between the statements made by the local leadership (i.e. ward councillors) and the EWS Policy. The ward councillors were promising the communities that the UDDTs were a temporary solution and the flush toilets were still coming. On the other hand, the EWS policy was clear that the UDDTs were not a temporary solution since there was no infrastructure for flush toilets. In eThekweni municipality: sewage disposal by-law, 2014 that was adopted by council clearly states in level 13 (1a) that the sanitation provided to domestic households must be in the form of one of the following methods (a) a privately owned urine diversion toilet (b) if a municipal waterborne sewerage reticulation system is available, connection to such system; or (c) if a municipal waterborne sewerage reticulation system is not available, an on-site-privately owned sewage disposal system. UDDT is recognized by the bylaws of eThekweni as a formal structure.

The eThekweni Metro sanitation programme only covered household sanitation. Due to the separate funding for school and community sanitation, school sanitation was often ignored since the Department of Education focused on building classrooms as a result of high shortages in the province. However, the EWS project also focused on schools to make sure that the interventions at community level were complemented by the school interventions.

In many areas falling under the eThekweni sanitation programme, there was a lack of water services' provision. This hampered progress, because it meant lack of water for construction. It also made it difficult for Health Workers to get the hand washing message across to householders during the HH education phase, when there was lack of water.

Chapter 3: Research Design and Methodology

3.1 Introduction:

This chapter presents the methodology employed in this study. It presents the study design, study area, study population, sample size, sampling procedure, the data collection tools, and data collection and analysis.

3.2 Study design

The design of the study was selected based on the needs of the VUNA project. The project had a strong technical focus, however there was a need to understand the behaviour, attitudes and experiences of people using the UDDTs. Therefore, the ideal methodological approach to explore these latter factors was a qualitative approach. Literature has demonstrated that studies seeking to explore such phenomena benefit from the use of qualitative research designs (Denzin and Lincoln, 2000). The focus for this study was to explore the influence of health and hygiene education on the social acceptance, utilisation and maintenance of the UDDTs.

Denzin and Lincoln (2000) define qualitative research as multi-method in focus, involving an interpretative, naturalistic approach to the subject matter. This means that qualitative researchers study phenomena in their natural settings, attempting to make sense of, or interpreting such phenomena in terms of the meaning people make about them, as the selected theoretical framework emphasizes. This study used interviews that were recorded and analysed with a focus on how people used words to express themselves and found meaning. The qualitative researcher's role is to immerse her/himself in the social context of the target population and understand how that population views things and why they behave in particular ways (Corti & Thompson, 2006). In the case of this study the researcher wanted to understand why people would or would not accept the UDDT, and why they chose to use it in certain ways. The student researcher is a Black isiZulu speaking South African, as were the members of the communities provided with the UDDTs.

Triangulation of methods was employed so as to have rich data from different approaches which were compared during the analysis. Triangulation is often thought of as referring to obtaining information from multiple perspectives about phenomena (Olsen, 2004). The study therefore, used several data sources. The triangulation was achieved through first employing the quantitative methods by administering the questionnaire which aimed to (a) determine if the household is using the UDDT or not (b) to assess the condition of the UDDT if it well maintained or poorly maintained. The data from the two paged questionnaire was used to formulate focus group discussion that are homogenous in nature, that were of participants from households that were maintaining the UDDT well, poorly maintaining the UDDT and those who had the UDDT but chose not to use it. Thereafter the in-depth interviews were conducted

with local authorities (i.e. Ward councillors, ward committee members and previous education facilitators) to further explore and validate issues that were founded in the focus group discussions. Triangulation as discussed by Pope et al (2000) is helpful in that it addresses the issues of consistency and reliability.

3.3 Study setting:

The study was conducted in three rural areas within the eThekweni municipality, namely Zwelibomvu, Lower Maphephetheni and eHlanzeni (see map below). The areas are situated in different parts of eThekweni, Zwelibomvu is situated in the West, Lower Maphephetheni in the North and eHlanzeni in the South of eThekweni. Since 2010 several research studies under the VUNA project were conducted in different areas of eThekweni and when I started my research I had a handful of areas to choose from. The areas were selected because of they are located in different areas of eThekweni as Zwelibomvu is in the West, Lower Maphephetheni in the North and Hlanzeni in the south of eThekweni (see map below). The Lower Maphephetheni and Hlanzeni are deep rural because they are both 1h30 minutes away from the urban area whereas Zwelibomvu is only 29 minutes away from Pinetown. So the study wanted to also explore the difference between areas that were closer to the urban and those that were deep rural.

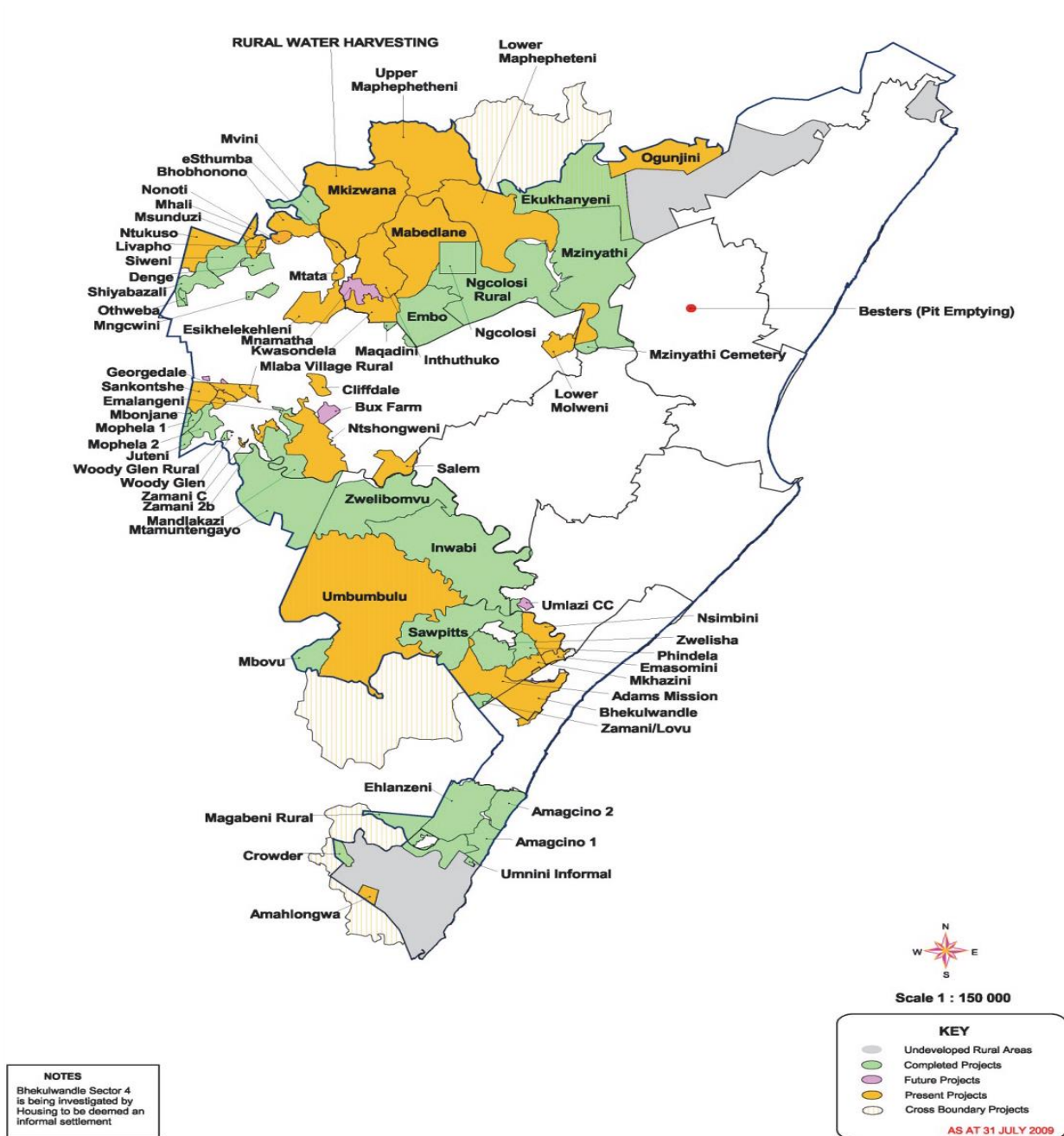


Figure 4: Map of eHlanzeni, Lower Maphephetheni and Zwelibomvu in eThekweni District.
Source: eThekweni Corporate GIS

3.3.1 Lower Maphephetheni

Maphephetheni village is located in a picturesque hilly area known as the Valley of a Thousand Hills approximately 80km from the city of Durban. It is a rural area characterised by dispersed settlement patterns. Maphephetheni is bordered by the Mqeka River to the west, and the Inanda Dam to the south, while the mountainous Pisweni and Matata plateaux are on the northern and eastern section of the village, respectively. The area is divided into upper and lower Maphephetheni, with the latter being on the southern side of the escarpment adjacent to the

dam. Rainfall in the area is far above the national average, keeping this part of the country green (Shisanya and Hendriks, 2014).

The Maphephetheni area is presided over by a traditional leader, Chief Gwala and a local community representative council. The overall population is estimated at 16 000 spread over 2000 homesteads (Shisanya and Hendriks, 2014). This means an average of 8 persons per household. Each homestead consists of an average of four dwellings, typically housing extended family members. The average total monthly income per household varies, but in 1998 it averaged at R1 392 (Green et al., 2010). Subsistence agriculture, small scale informal economic activities and small commercial enterprises are the main economic activities in the area.

3.3.2 eHlanzeni

eHlanzeni has 495 households with a population of 3277 and the main language is isiZulu (Okem et al., 2013). It has an average of six people per household.

3.3.3 Zwelibomvu

Zwelibomvu is a rural village outside the city of Pinetown, in the KwaZulu- Natal province, in the north east of South Africa. Zwelibomvu is one of the traditional authorities that, until recently, resisted the influence of popular democratic movements into their areas. Zwelibomvu is under Nkosi Mkhize and it also has political leadership. Zwelibomvu has 784 households with a population of 8887 and the main language is isiZulu (Okem et al., 2013). There is an average of eleven members per household. The households are sparsely located and most houses are informally built which means the structures are not approved. They are mainly made of mud and blocks.

3.4 Study period

The study commenced in January 2013 and continued until April 2015. It lasted 30 months, where (1) the first four months was used to develop the proposal, (2) three months were used in consulting with the local authority, (3) five months were used for the data collection, (4) four months for the data analysis, (5) three months for developing the health and hygiene education material, (6) five months for the education roll-out, and (7) six months for the final report and scientific publication. The above was the plan of the study but not everything went according to these timeframes because there were challenges which had a great effect on time issues. These issue are further discussed in 3.16 and in the discussion section page 84.

3.5 Study population:

The target population for this study was people from households that had been provided with the UDDT by eThekweni municipality. The focus group discussion (FGD) were individuals that were nominated by families of the forty households that were visited to administer the questionnaire in the three target areas. In total 120 household were visited and each household was requested to nominate one person to represent them in the focus group discussions. The in-depth interview participants were made of individuals that were rendering HHE for EM previously in their respective communities, the ward committee member and the ward councillors. The participants were required to be 21 years and above and this was highly emphasized when the household visits were made that the family will need to nominate someone within that age range. The composition of the groups was mixed in terms of gender and age.

3.6 Study sample:

In each target area 40 households were randomly selected, in total 120 households were visited using the aerial map of EM that has all households that were provided with sanitation services by eThekweni. The households were then physically identified by the study research assistants and they were then visited confirming each household with the number allocated in the areal map. The two page questionnaire was administered in each household visited and each household had to nominate one member of the family above 21 years of age to participate in the focus group discussion. A contact number was taken on the day of the visit so as to advise each household of the time, venue and date of the focus group discussions. In total 121 people participated in the focus group discussion because in one household two people attended. The in-depth interviewees were purposively sourced and 25 individuals participated over the three areas, see Table 1.

Table 1: Category and number of in-depth interviewees

Category of Interviewee	Number
Ward Councillors	4
Ward committee members	9
Previous education facilitators	12
ISD	1

3.7 Sample size:

The study used mixed methods meaning both qualitative and quantitative methods were employed. In the quantitative phase 120 households were randomly selected using the EM's

areal map, in each household, one family member was nominated to participate in the focus group discussion as a result 121 people participated in the focus groups as one household sent two people to participate. Thereafter, purposive sampling was used to select 25 in-depth interviewees because the student needed local people that were involved in roll-out of the UDDT project hence ward councillors, ward committee member and the previous education facilitators were candidates of the in-depth interviews. Miles and Huberman (1994) further state that purposeful sampling permits the selection of interviewees whose qualities or experiences are relevant to the study. In each of the three areas five focus groups were held, two maintainer group, two non-maintainer groups and one non-user group in each area, see Table 2. The size of focus group member varied from five to twelve and sessions varied from 50 minutes to 1 hour. The in-depth interviewees one person was interviewed at a time and it took 35 to 1 hour per session.

3.8 Sample recruitment and procedure:

The focus group participants were recruited using the following procedure: (a) 40 households were randomly selected per study area from an aerial map. (b) Each selected household was visited by trained facilitators, and a two-page questionnaire described in section 3.9.1 was administered. Each visited household selected one family member 21 years and above to represent them in the focus group discussion. The selected person's contact numbers were recorded by the facilitators. (2) The information collected from the questionnaire was used to create homogeneous groups with regards to the condition of their UDDT (i.e. maintainer (those who were maintaining the toilet properly), non-maintainer (those were poorly maintaining the toilet) and non-user (those who had the UDDT but chose not to use it), please see Appendix D. (3) The selected family members were then called to arrange appointment dates for the focus group discussion for each category. The focus groups were then held with the relevant participants.

In selecting in-depth interview participants, a purposive sampling method was used. The EM database of people who were employed to provide the education was available and it was used to contact the individuals. The interviewees were contacted telephonically to explain about the study and to request their participation and then the appointments were set. In all three areas the ward councillors were in the position for a decade which means they were still ward councillors when they were first installed in their areas. The ward councillors provided us with information regarding the ward committee members and they were contacted telephonically and the appointments were set. We did not have a challenge with participants, they kept to time and honoured the appointment only three events where we had to reschedule the appointment. The participants were the ward councillors, ISD, ward committee members and previous education facilitators. The participants were selected according to the role they played in the roll-out of the UDDTs project. The Institute for Social Development (ISD) representatives was interviewed as well. We could only get hold of one ISD out of three because they were busy at the time and the other one was out of town

and was not interested. The ISDs were employed by EM to provide training and manage the health and hygiene implementers (facilitators) from the community.

3.9 Data collection techniques and tools:

Rogers and Bouey (1996) state that the data collection tools should be selected based on the nature of the data to be gathered. Different instruments were therefore used for this exercise. Qualitative methods were mainly used to collect the data in the form of focus group discussions (FGDs) and in-depth interviews (IDIs), but quantitative methods were also used (i.e. use was made of the prior questionnaire survey). The tools were developed in order to allow facilitators an opportunity to probe deeper into the issues, being flexible, and not being intimidating for the participants, so that they would be able to respond openly and honestly. The information collected during the desk top analysis process and literature review was used to inform the development of the questions.

The question guides were used for the focus groups and in-depth interview as tools. The guides broadly explored questions on the following topics: (see appendix E & F)

- Acceptance:
- Usage / operation
- Maintenance

The focus group guide explored the introduction of the UDDT to the community, what was communicated to them by who, was the consultation sufficient or not. It then explores the attitude, feeling and behaviour users possessed as far as the UDDT was concerned. The questionnaire guide then prompts the participants about what they actually do when it comes to maintaining the UDDT: how many time times they clean it, how they clean, who cleans it and what do they use to clean it. The question guide then moves to how the participant feels about the re-use of urine. The question guide then dwells on the health and hygiene education: did they receive it, what was the content, did the family member pass on the message, if yes how. The guide also explored the issue of acceptance, to see if the participants/ users view the UDDT as the permanent asset of their household or not.

The in-depth interview schedules then explored issues of acceptance, usage, maintenance and health and hygiene education on a more individual basis. The questions aimed to find out if the participants felt they did well in introducing the UDDT's in the community, if the UDDT is being used as it was intended by the community, if no, what can they do to change the situation, what do they feel they did correctly or wrongly.

Below are the data collection tools that were used in the study.

3.9.1 Two page quantitative questionnaire

The two page questionnaire had a demographic section where the households were asked about the number of people in the house, number of children and adults (see appendix D). The second section asked about the usage of the UDDT. The third section required observing the toilet in order to assess if it was in a good condition or not. The questionnaires were filled by the research assistant, because some of the people could not read nor write. In order to keep a uniform standard, the facilitators asked the questions in isiZulu and completed the questionnaire as the participant responded. The household was then left with the information letter, so that people who were absent would be properly informed about the visit. The information letter contained the details about the study, the purpose of the visit, and that the household would be contacted to set an appointment date for the focus group discussion (see appendix H). The participant(s) was then asked to nominate one person in the family 21 years and older to represent them in the focus group discussion that was going to be held one week after the visit. The contact number of the nominated family member was then taken to communicate the date and the time with the individual.

3.9.2 Focus group discussions (FGDs)

The participants of the focus group discussions were individuals selected from each household that was visited to administer the two page questionnaire. The focus group discussions were homogenous in nature, (see Table 4) the participants were divided into three groups in each area using the information that was gathered from the two- page questionnaire, it was (1) the non-users, those who had the UDDT in the household but they chose not to use it (2) the well maintainers, these are were people that using and maintaining the UDDT properly, the UDDT items are still intact and the UDDT is functioning properly (3) the non-maintainers, were those who has dysfunctional UDDT's and they had broken items in the toilet. The focus group question guide was informed by some of the data that were gathered from the two page questionnaire. Those who were interviewed in HH visits were invited to participate in the FGD. The question guide (see appendix E) was structured in a manner that discussions on average took about one hour, though at times it took longer. Probing method was used to get all participants actively involved and participating by asking clarity on questions. Summarising and paraphrasing was also used to ensure that the research assistants understood what participants were saying which also gives participants assurance that they are listening. The question guide had five sections including the observation component. The question guide was adapted for the different areas included in the study. The questions were first developed in English and then were translated to isiZulu and back translated to ensure clarity.

Table 2: The dates and number of focus group discussions.

Date	Area	No. of participants	Category
10 June 2013	Hlanzeni	12	Non maintainer
10 June 2013	Hlanzeni	10	Maintainer
10 June	Hlanzeni	9	Non-Maintainer
10 June	Hlanzeni	4	Maintainer
11 June 2013	Hlanzeni	5	Non-user
Zwelibomvu			
Date	Area	No. of participants	Category
07 July 2013	Zwelibomvu	8	mantainer
07 July 2013	Zwelibomvu	8	Maintainer
07 July 2013	Zwelibomvu	12	Non-mantainer
08 July 2013	Zwelibomvu	9	Non-mantainer
08 July 2013	Zwelibomvu	4	Non-user
Lowe Maphephetheni			
Date	Area	No. of participants	Category
05 May 2013	Lower Maphephetheni	8	Non-maintainer
05 May 2013	Lower Maphephetheni	7	Non-maintainer
05 May 2013	Lower Maphephetheni	9	Maintainer
06 May 2013	Lower Maphephetheni	9	Maintainer
06 May 2013	Lower Maphephetheni	7	Non- user

3.9.3 In-depth interviews (IDIs)

The question guide (see appendix F) for the in-depth interviews was mainly informed by the responses that were gathered from the focus group discussions, and was used to probe and elaborate on the issues raised. The questions were first developed in English and then were translated into isiZulu and back translated. All the information collected was used to develop the health and hygiene education material, which was later implemented in two of the study areas namely, Zwelibomvu and Lower Maphephetheni.

3.10 Research assistants and facilitators training:

The six research assistants were all tertiary undergraduates who had health and marketing degrees/ diplomas. They were contract employees of the eThekweni Water and Sanitation section and worked on various issues related to water and sanitation. However, their role in the study was to collect data, translate from isiZulu into English, and transcribe the FGDs and IDIs

that they had facilitated. They also assisted in the implementation of the health and hygiene education material. The two local facilitators were sourced from each study area and their role was to be the eyes and ears of the research team in the community. To link the research personnel to the community vice versa.

The research assistants were trained, before they worked in the study, in a one day course that covered (1) what the study was about and its role in the VUNA project, (2) their role in the study, (3) how to conduct research especially the qualitative research, (4) role of research assistants and that of the local facilitators, (5) data collection techniques, (6) data collection tools, (7) the dos and don'ts when collecting data using questionnaires, focus groups and/or in-depth interviews. A training module was formulated for this course (see appendix J).

The assistants were later trained on the health and hygiene education material and how to implement it, emphasising that they are research tools, what they say and do has an impact on the responses people give and how they react. This was to emphasise that they need to stay neutral. The manual included role playing and other exercise to help make the theory more tangible and practical. The research assistants were mainly female. There were six research assistants in total, and only two were males.

3.11 Researcher's role:

Deborah, (1998) asserts that qualitative research involves the researcher as an instrument, where the researcher's use of self is a primary tool for the data collection. The student researcher has experience in being a researcher. She started in 2000 as a research assistant. In 2006, she was a research coordinator. In her work as a researcher for six years, she was exposed to qualitative and quantitative methods. She has worked for more than six years with rural communities, which was advantageous because she has an understanding of their way of life and their culture. At that time she administered questionnaires and also conducted focus groups and interviews with different age groups and sexes. The researcher is an isiZulu first language speaker, and this same language was used in all the study areas. This made it easy for the researcher to understand what the communities were communicating. However, the researcher's experience helped her to understand the importance of not making assumptions, but always working with the people to get a concrete understanding of the situation at hand. As such she participated in the collection of data and worked from a naïve position, because it was the only way she could fully explore people's perceptions, attitudes and behaviours. The latter was crucial, since the analysis was largely based on what people said. The researcher participated fully in the data collection process, because it allowed her the opportunity to engage with people first hand. It also allowed the research assistants an opportunity to obtain support where necessary. The researcher worked closely with the research assistants in the translation of the data collection tools from English to IsiZulu and later in the training session the six local facilitators also had a chance to read through the material to see if the communities will understand. The researcher was also responsible for supervising and overseeing the research, each week the researcher had a brief meeting with

all the assistants to talk about how it going so far and what the challenges are and how we can address them. The assistants also had my mobile number to contact me if there was an urgent matter that they needed clarity or support on.

3.12 Data handling and analysis:

3.12.1 Questionnaire

The 120 completed questionnaires were captured using the Microsoft Excel spreadsheet package the same day they were completed, and then saved in an electronic folder that was password protected. Only the researcher and the research assistants had access to this folder. The hard copies were handed to the researcher after they had been entered, and put away in a locked cupboard. The original completed questionnaires will be archived six months after the finalisation of the study. In all areas the questionnaires were completed.

3.12.2 Focus group and in-depth interviews

The data from the focus group discussions were recorded using a digital recorder. The files were subsequently downloaded onto an electronic folder that was password protected. The password was only known to the research assistants and the researcher. The recordings were translated and transcribed from that folder. The files will be archived six months after this Masters in Medical Science is complete. The FGDs were conducted by either a female or male assistant, because the participants reported that it made no difference and they did not perceive the topic to be of a sensitive nature. The IDIs were conducted by two assistants at a time, with one assistant taking notes and monitoring the non-verbal communication whilst the other was facilitating the conversation.

3.13 Dissemination of findings:

The final thesis will be submitted to the School of Nursing and Public Health of the University of KwaZulu-Natal. Another copy will be taken to the University of KwaZulu-Natal (UKZN) library for public perusal. In addition, an article has been written with the aim to publish this study in a peer reviewed journal and present the information at relevant conferences. At the community level, the information was initially shared with ward councillors of the areas in which the UDDTs had been installed, including those that did not participate in the study. The findings have also been reported to the VUNA community, presented to EM, presented at UKZN College of Health Sciences Research Day in 2015 (see page viii) and the paper on this thesis has been approved by Journal of Water, Sanitation and Hygiene for Development.

3.14 Measures to ensure credibility and dependability

3.14.1 Credibility

Rolfe (2006) describes credibility as the degree to which the results of the study are believable. In this study the information was collected from the household members whom had had a UDDT. The study shows that 89% of the participants were using the UDDT and only 21% were not using the UDDT. Therefore this makes the study credible because the information was collected from the relevant people. The participants were not coerced to participate and in the informed consent they were fully informed that they can stop participating at any time they want and they are not compelled to answer when they do not want (see Appendix I). A standard format was used on how the research assistants were to introduce themselves and the study, this ensured that the participants had a similar understanding and to avoid bias in the information given.

3.14.2 Dependability

Dependability is ensuring that the results are trustworthy and if the study was to be repeated the same results would be found, (Patton, 2002). The tools and questions used in the study were informed by previous studies, (Kvalsvig and Ngcoya 2006; Roma et al., 2011 and Flores et al., 2009). The people that participated in the study were not coerced, but willingly participated. They demonstrated this by signing informed consent (see appendix I). Their personal information was not recorded, hence guaranteeing anonymity. The focus groups were homogenous in nature, and that allowed participants to talk without feeling judged. Three methods were used to collect data and this allowed for comparing and verification of the data obtained.

3.15 Ethical consideration

Ethical clearance for the study was obtained from the University of KwaZulu-Natal (UKZN) Biomedical Ethics Research Committee (BREC) (see appendix B). The permission to enter and conduct the study in the community was obtained from the ward councillors (see appendix G) and they also provided permission to conduct observations in the community. However, the identities of the people observed were protected.

3.15.1 Informed consent

The Declaration of Helsinki (1964) states that informed consent is a prerequisite for all research involving human beings and a signature of the research subject demonstrates that an informed decision was made. The written consent was given by all participants that participated in this study. The research assistants were well trained on the importance of obtaining informed consent before starting each interview. The scope of the study and the content of the informed

consent were narrated by the research assistants, where the participants were informed on how the study was going to be conducted. The informed consent document was inclusive of the request to use a digital recorder, and explained why it was necessary to use this. Thereafter the participants were allowed time to indicate by signature if they wanted to participate or not. None of the targeted participants refused to participate.

3.15.2 Confidentiality

Privacy and confidentiality were addressed for all participants. The research assistants were also trained on these issues, in terms of respecting people's privacy and keeping what is communicated, confidential. The participants were allowed to be anonymous and the introductory session was not recorded. During the informed consent process, they were given an opportunity to indicate their willingness to participate by making a cross or any written sign. The questionnaire had a section where the house number was captured. At the end of the page the contact number and the name of the person selected by the family to represent them in the focus group discussion were recorded. It was thoroughly explained to the participants why the numbers were recorded. The participants were informed that they could choose not to give their contact numbers, and withdraw their participation at any point. To ensure confidentiality the discussions and the interviews were conducted in a neutral place.

3.16 Field challenges:

The challenges in this study affected the timelines and the time of completion. Late ethical approval of the protocol by the UKZN BREC was a challenge as data collection started later than planned. The application was sent in March 2013 and only received approval to start working on the study in 3 October 2013. Securing appointments with ward councillors and the Inkosi (the Chief of the area) proved to be difficult, but eventually a meeting was secured to present the study and permission to conduct the study was obtained (see appendix G). Securing appointments with interviewees, schools and workshop members proved a challenge, and as a result some of the schools and workshops were cancelled. The Zwelibomvu and eHlanzeni areas are rocky and hilly, so it was difficult to visit as many households per day as it was initially planned five. There was a challenge with three of the houses in total that we could not locate from the aerial map used in the study and in such cases, we wrote ten houses closer to the point of reference piece of paper and one research assistant will close her eyes and choose from the hat to ensure that the household was still randomly picked.

Initially for the HHE rollout 25 households were visited in each of the two areas to deliver HHE. The households visited were randomly selected using the aerial map. In some cases we would visit the selected household only to find the house does not have a UDDT. In such cases the research team randomly selected another house as a substitute using the hat method above. Furthermore, the selected cartoonist did not deliver the material on time and the project had to start without receiving the comic book and poster planned for the health and hygiene education

intervention. The time in which the programme was implemented was problematic, since national elections were held on the 28th of April 2014. This was the reason why some of the groups that were to participate in the programme ended up not participating.

Chapter 4: Findings

In the study two methods were used namely the quantitative (two page questionnaire) and qualitative (focus group and in-depth interviews). The findings from the two page questionnaire will be first presented as it will give us an overview of the condition of the UDDT's. The second section of the findings will report on the qualitative results gathered from the focus group discussions and the in-depth interviews as they explore what are factors around the use, maintenance and acceptance of the UDDT.

Quantitative findings:

From the data collected through the two page questionnaire, the figure 5, 6 and 7 were developed. The data shows 89% of the households were using the UDDT, then the households were categorised according to whether or not the toilet was in a good condition.

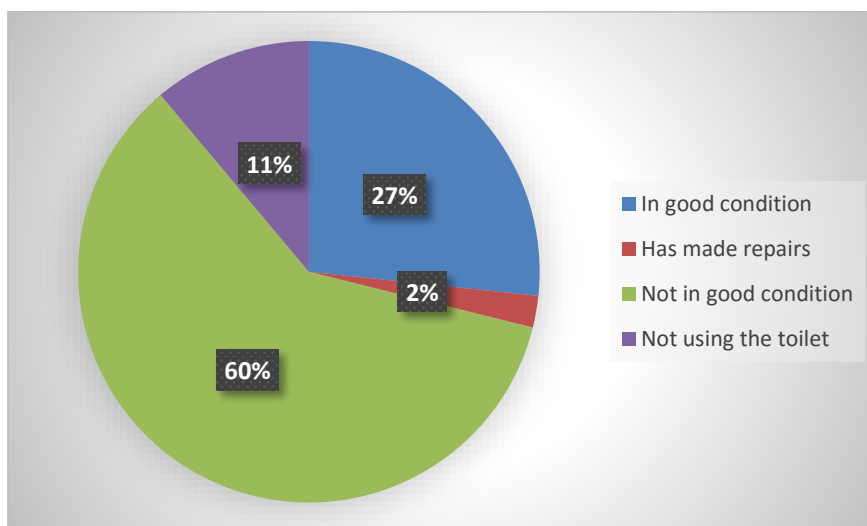


Figure 5: Observed condition of the UDDT, provided by eThekweni, n=120

Figure 5 shows the trend that was observed in all study areas where more than 60% of the households were not maintaining the UDDT properly. Information was gathered using the two page questionnaire where the UDDT was to be observed inside and outside by the person administering the questionnaire who was the research assistant that went through training on how the UDDT condition should be, figure 7. In most cases the doors were found to be missing or broken, the toilet seats were broken, the back covers were also missing and the vent pipes broken as elaborate in Figure 6 below.

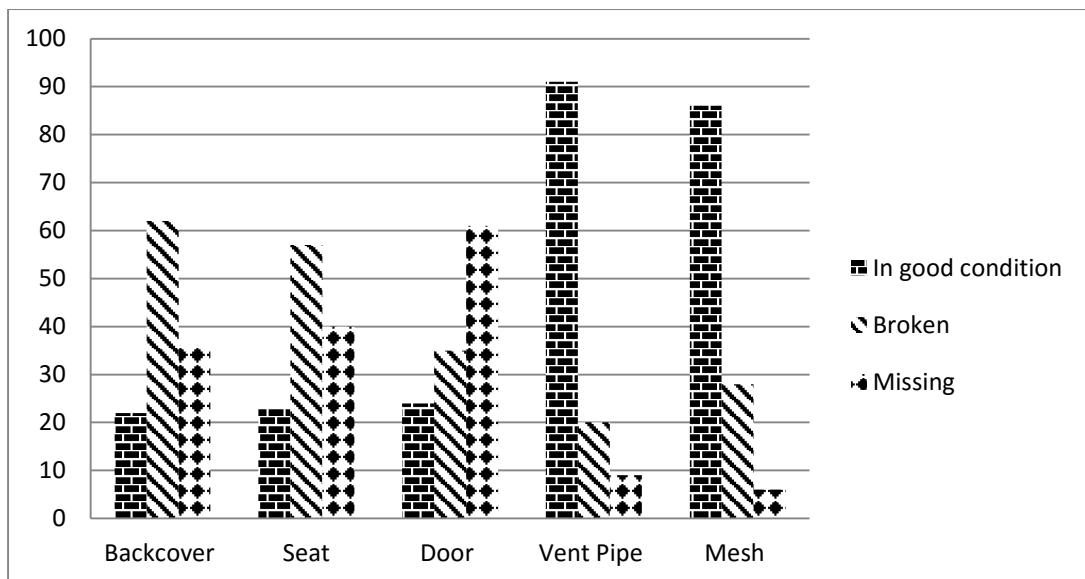


Figure 6: Condition of UDDT constituent items (n = 120).

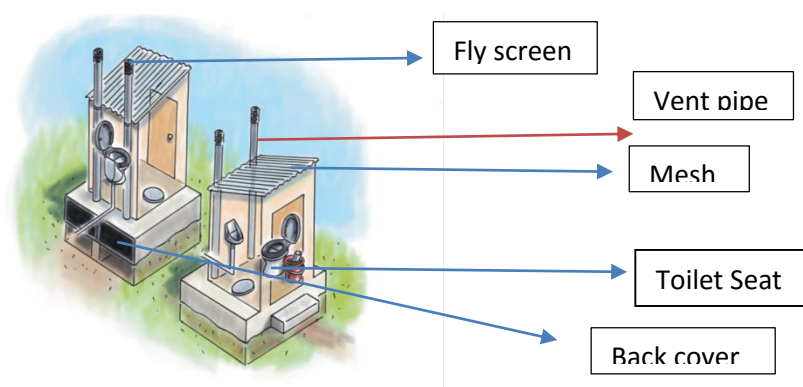


Figure 7: UDDT showing different constituent items

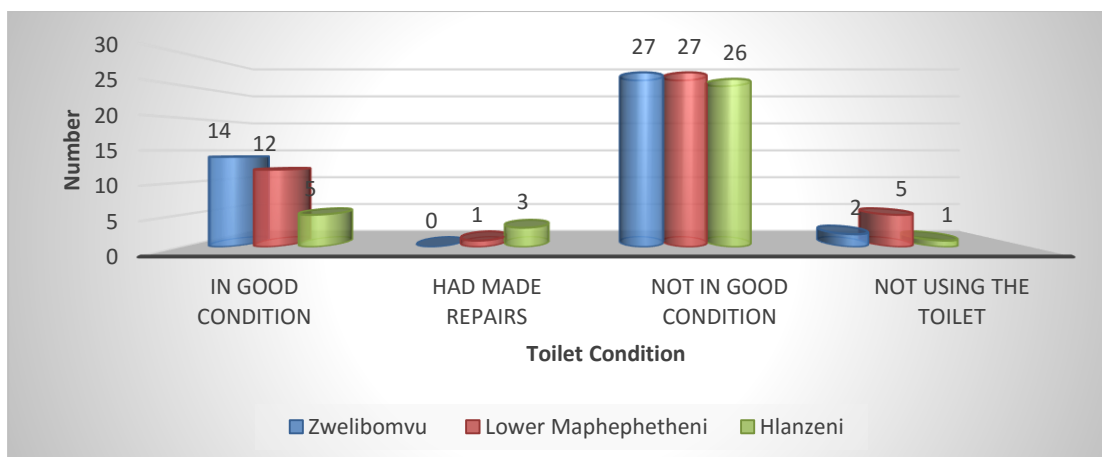


Figure 8: Maintenance, condition and use of the UDDT Comparing the condition of the UDDT, n=121

There were very few households that were not using the UDDT in all three areas. However Figure 8 shows that compared to other areas Zwelibomvu had more households with a UDDT in good condition. The good condition of the toilet were the UDDT's that were functioning as they were meant to be and when broken they were repaired with the appropriate item. Whereas the UDDT's that were classified as not being in a good condition were those that had broken items and there not functioning as they are supposed to. Lower Maphephetheni had more people that were not using the UDDT. These data were used to create categories in which participants were grouped. The categories are classified in Table 4 below.

Qualitative findings:

The descriptive data below was gathered from focus group discussions and in-depth interviews to view the age and sex of the participants. Table 3 is to give a background of the participants of the focus group discussions and the in-depth interviews, of what gender they were and the age.

Table 3: Age and sex of focus group discussion and in-depth interview participants.

Category	Sex	Age	Percentage
Focus Group Discussion	Female: 85	21 yrs -35 yrs = 21	17.4
		36yrs -60yrs+= 64	52.9
	Male:36	21 yrs -35 yrs = 11	9
		36yrs -60yrs+= 25	20.7
		Total	121

In-depth interviews	Female: 19	21-35 years= 12	48
		36-60 years= 7	28
	Male: 6	21-35 years = 6	24
		Total	25

Table 3 above, indicates that most of the participants in the FGD were adult females. In some households they said that the reason for the choice is that they know they will definitely come because they are responsible hence it was mostly older females of the households who were chosen to participate. The reason in many households given for the choice of their representative was that they had no commitments on that particular weekend. The youth participation was the least in both the female and male categories.

Table 4: List of categories and definitions

Category	Explanation
Maintainer	<i>Were households that had their UDDT in a good condition where all toilet items intact e.g. door, vent pipe etc. in place. The broken items were repaired using appropriate materials. This data was taken from the observation section of the questionnaire.</i>
non-maintainer	<i>The UDDT is in a bad condition: it has broken door, seat, vent pipe, mesh, back covers, and when one of the latter items are it will be either not repaired or be repaired using the inappropriate material. This data was taken from the observation section of the questionnaire.</i>
Non-user	Households that have a UDDT but choose not to use it. This data was taken from the observation section of the questionnaire.

Well maintained UDDT:

The maintainers as described in Table 4 comprised less than 30% in all areas and the data shows that these households had more children than adults, compared to the other categories. Figures 9, 10 and 11 below confirm this trend and it was gathered in all areas using the two-page questionnaire. The participants in the maintainer group reported that children in their households between 9 and 16 years partook in cleaning of the UDDT including the urinary that is used by males to urinate because if they are to urinate using the toilet the chances are that the urine will slide into the back hole which is only meant for faeces. However, they made it very clear that the cleaning was not only for children but it was shared amongst all female members excluding older males. The clarity was also given that emptying was not done by

children but mainly by older females in the household and sometimes older males. The sharing of chores was only reported in this group but not in the non-maintainer groups where chore to clean and to empty the toilet was left to one member of the family. The younger females in all groups were excluded from emptying the toilet but only few people reported that it was due to belief that they will have bad luck. When this response was probed into what they meant by bad luck the participants referred to bad luck of not getting married. However, it was clear that the male counterparts are not even considered because it is not regarded as their chore to do domestic work hence they refer to females.

“My child still has a lot ahead of her so I do not want her being in contact with such things (faecal matter) she will end not getting married” (others giggled). (Focus group participant)

The participants with well-maintained UDDT reported that the cleaning of the toilet was a task for one or two people in the house, in many households it was mainly old women and children between the ages of 9 and 16 years who were doing this task. They were not happy with task and this resulted not cleaning the UDDT as often as they should and not cleaning it the way it supposed to be.

“I need a break from cleaning the UDDT as well, it is a very tough job, so sometimes a month goes by without cleaning it and even if I do, I do it fast so I finish quickly” (Focus group participant)

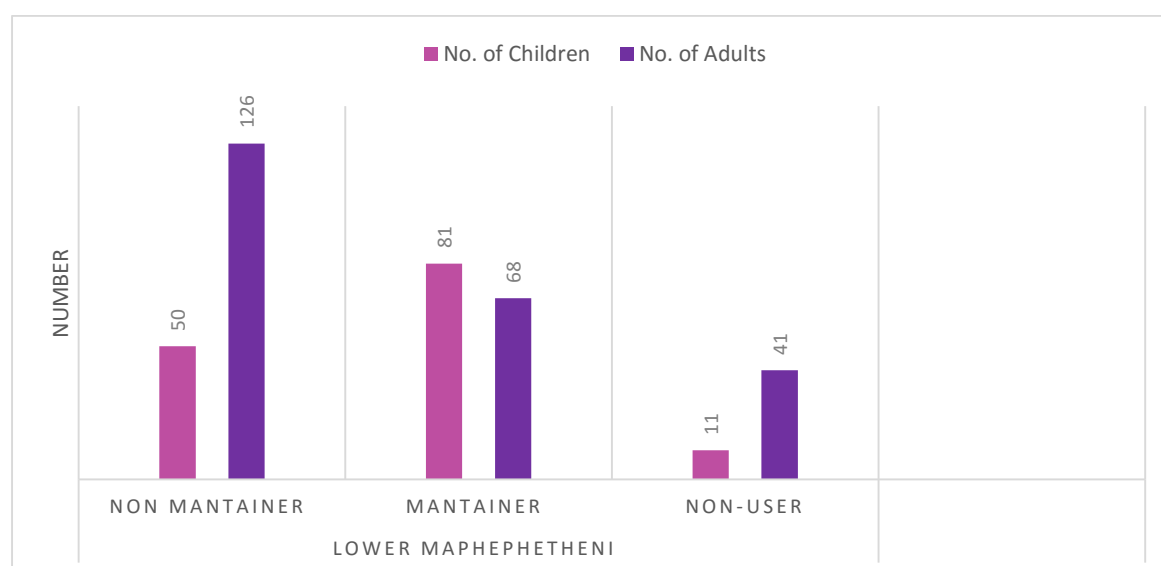


Figure 9: Characteristics of households maintaining/not maintaining UDDT, Number of adults vs children in household

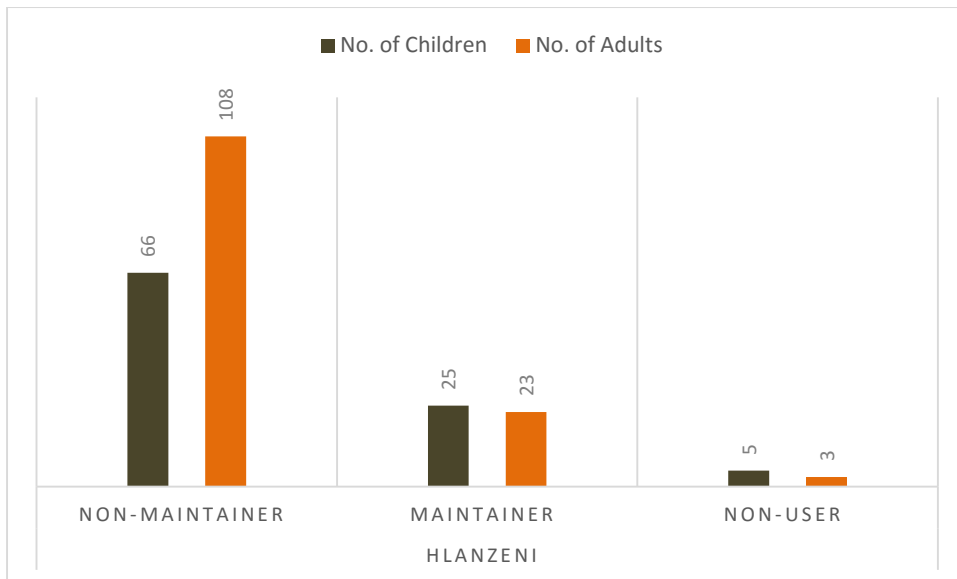


Figure 10: Characteristics of households maintaining/not maintaining UDDT, Number of adults vs children in household

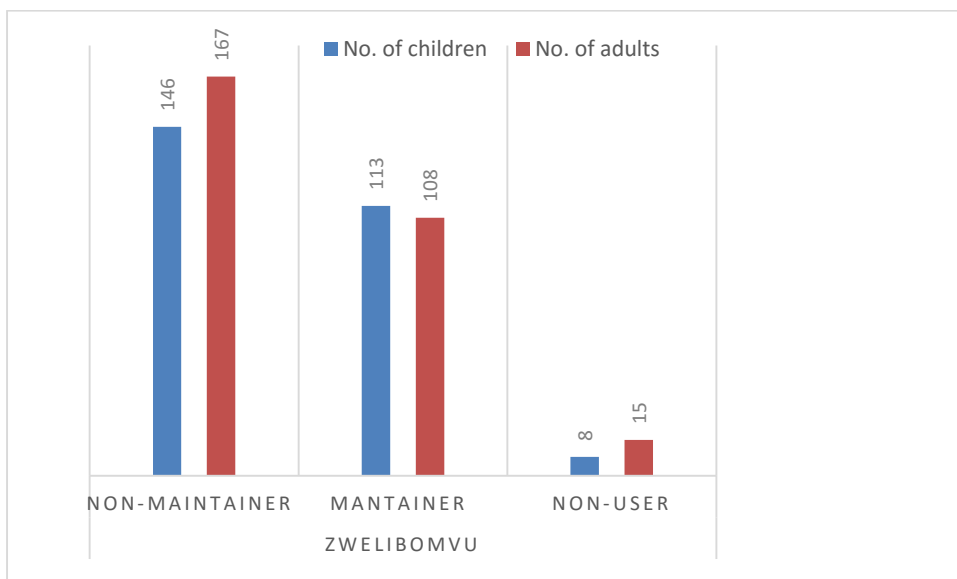


Figure 11: Characteristics of households maintaining/not maintaining UDDT, Number of adults vs children in household

Poorly maintained UDDT:

The main characteristic in the non-maintainer group was that they could not afford to repair the UDDTs broken items such as the door, vent pipe, and/or toilet seat with the proper material

as seen in the Figure 12 below. If these items are not properly repaired, it then disrupts design of the UDDT and the functioning of the toilet system. The vaults of the UDDT are to be changed around, when the first one is full the second one is to be used to allow the first one to dry. So in the case of the examples given below the UDDT cannot function as it supposed to. The other characteristic for the groups was the lack of cleanliness of the UDDT.



Figure 12: The poor repair of toilet seat (a) and door (b)

Some participants reported that the main reason why they did not repair the toilet was because they did not view the UDDT as a permanent asset. Some reported that they were waiting for government to provide them with better toilets, whilst others explained that this was because they were planning to convert UDDT to a flush toilet or a septic tank once they have money to do so.

“I cannot afford to buy a door to repair a toilet when my house is falling apart, we are unemployed and so are our children” (In-depth interviewee, previous education facilitator).

“I would rather I buy food than to buy a seat for the toilet, how is that going to help me” (Focus group participant)

Lack of education:

The majority of the participants in the non-maintainer FGDs reported that they did not receive education first hand, hence in the previous HHE that was rendered by EM the education was given to one person that the facilitators would find at home and that one member of the family will be tasked with the responsibility to relay the message to the rest of the family. The large proportion of the participants in the non-maintainer group reported that the family recipients of the education did not relay the information on how they should maintain the toilet so they do what they think is right.

“I have never been formally informed about how to take care of this toilet, I do not even know who received the information in the family, I just clean the UDDT in a way I think is right” (Focus group participant)

“I use a detergent that we have in the house but I normally pour the domestos inside the toilet to kill the germs” (Interviewee, previous education facilitator)

“I pour the soil once a month so the toilet does not fill up too quickly” (in-depth Interviewee, ward committee member)

Whereas the in the maintainer FGDs the participants reported lack of HHE, they did not know everything but they have basic information on how to use and maintain the UDDT. They knew that the ash is to be poured after every defaecation and they also knew that they have to move vaults when the other once is full. However they lacked information as far as how they are to empty the faecal content in the vaults and bury them.

Acceptance:

The fact that many people did not view the UDDT as a permanent asset was an indication that although they are using it, they had not accepted nor taken ownership of it. This line of thinking was predominantly due to the belief that the UDDT was a temporary measure, and the government will soon provide them with a flush toilet.

“I’m waiting for my flush toilet there is no way that this toilet is permanent...I will not accept that.” (Focus group participant).

There was also a perception that the UDDT was a toilet for the poor.

“Wealthy people convert these toilets to flush or septic tank, so it’s only us who cannot afford that are still using them, as we were given them.” (In-depth interviewee, previous education facilitator).

The acceptance of the toilet varied within the groups, especially according to age. In the focus group discussions the younger participants between the ages of 21 and 25 years were more accepting of the UDDT, mostly because they grew up using the toilet, compared to the older users who argued against the UDDT in the focus group discussions because they had been exposed to other forms of toilets. The older participants in their discussions they would refer to other forms of toilet that they have used before comparing them with the UDDT whereas that was not the case with the younger participants.

The participants reported that they did not talk about UDDT as a family and/or community.

“Why should I talk about something I do not like and that is embarrassing to me...I don’t talk about it at all.” (In-depth interviewee, ward committee member).

This is an indication that people did not accept the UDDT as a benefit to their community.

The ward councillors in their statements when they were introducing these toilets they were not clear in saying that the UDDTs were a permanent solution but they somewhat gave an impression that THE UDDTs were a temporal measure.

“I have never mentioned that the UDDTs are a permanent solution to people because it is clear that they do not like the toilet and I do not want it to seem as though our municipality is failing” (Ward councillor).

“How do I tell people to accept something they do not like, we as leaders have to find ways to calm the situation until people get used to them UDDTs” (Ward councillor)

Non-user:

The non-users were very few in all areas. 11% of households were not using the UDDT, and all these households were still using the VIP toilet. All of these households had their UDDT installed more than five years ago. This means that they may have built the VIP on their own after the UDDT was installed. They were using the VIP toilet, because they preferred it to the UDDT.

“The reason why we (family) chose not to use these toilets - it is the fact that we have to empty them ourselves.” (Focus group participant).

Some people were using their UDDT as a store room, whilst others were using it as a place to bath.

Using the toilet:

The toilet was used by 89% of the people. However, people used the toilet not because it was their preferred choice. The participants stated that this is the toilet that was provided to them by the municipality for free, it was better than not having a toilet at all or a toilet that is made of unstable material.

“We have no alternatives that is the reason we use this (UDDT).” (Previous education facilitator- In-depth Interviewee, previous education facilitator).

“ we might not like the UDDT because it is not the best, it is not flush but at the end of the day it is better to have something you call a toilet than not to have one at all or something that might fall at any minute” (Focus group discussion)

User-friendliness:

The ward councillor said:

“It is too technical. Having to make sure that the urine goes to which hole, it undermines the comfort and peace that one should have when using a toilet”. (In-depth interviewee, ward councillor)

The majority of the participants felt that it was not comfortable to use UDDT, because people had to be mindful, all the time, whether the urine or faecal matter was going to the right place.

“I do not want to think about the toilet, when I’m in the toilet. But it should be a place where I can relax and even read.” (Focus group participant).

The participants also reported that UDDT were dark inside and this was the reason why most children did not close the door.

“I cannot even read a book if I am inside, it is just too dark and that is why at times we open the door a little just to let the light inside” (In-depth Interviewee, ward councillor)

Children not using the toilet:

The majority of the participants reported that the children who were not using the toilet practised open defaecation instead. The children that were less than four years of age were not encouraged to use the toilet. The main reason was fear that they might fall into a hole and injure themselves or die.

“So to be safe I would rather they did not use the toilet until they are old enough...at least be 6 years old.” (Focus group participant).

Maintainers:

The maintainers were able to keep their toilets in a good condition for a number of reasons. One of the reasons was that they shared household chores as a family and they rotated the responsibility of cleaning the UDDT which includes cleaning the urinary. However, they did not allow one person to be burdened with the cleaning of the toilet.

“I always find that it works better, if we all take turns in cleaning it (UDDT) and give each other breaks.” (Focus group participant).

“The urinary is not a problem to clean because it does not have a bad smell” (Focus group participant)

This category had an average of seven people per household compared to other categories which had more people in their households. The maintainers also reported that the people who received the education were younger and provided more information about health and hygiene education to other family members.

Non-maintenance

The non-maintainer group was not regretful nor ashamed of the fact that their toilets were not in a good condition. Instead these respondents blamed government, and expected the government to come back and repair the toilets for them. In this group most of the people that received the education about the UDDT were older and were either deceased or had migrated.

“The person that received the education no longer lives at home, so there is no one we can ask if we forget.” (In-depth Interviewee, ward committee member).

Roll out of health and hygiene education:

The previous facilitators generally felt that they did not do a perfect job when they visited the households. The main reason was that they received training only once which lasted one day. The other factor was that the facilitators that joined after that training were only briefed by the original facilitators on what they should do. The facilitators reported that they did not visit all the houses that they had to, because of the weather and some houses were too far.

“Some houses I would visit once and not go back again because of the distance.” (In-depth interviewee, previous education facilitator).

“If it’s too hot I would visit few houses and go back home...otherwise we would die.” (Laughed) (In-depth interviewee, previous education facilitator). Laughing was an indication that she did not realise the negative impact her actions might have caused.

Reception of health and hygiene education:

The majority of the participants reported that they did not receive the education about the UDDT directly, and less than 50% of them were informed by the family members that had directly received it. The few people that had directly received the education said that they did not remember most of the things they were told. The majority of the participants reported that the facilitators only came once instead of the five times that they were supposed to and they came after the toilet was installed.

“They came to my house once to tell me about the toilet and how I should use it.” (Focus group participant).

Impression of health and hygiene education:

Some participants reported that they had received the education and said the facilitators came when the toilet was built and they gave them a bucket, rake and a cup. Hence, not all

participants received education first hand from the facilitators or even from their fellow family members. They just saw a toilet in their yard and they had to figure out themselves how to use it. The health and hygiene education advised that the bucket with ash or sand should be in the toilet at all times for each access. The participants reported that they no longer keep the bucket in the toilets because they used the buckets for other household chores hence the sand or ash is not poured into the toilet after defecation.

“Hahahaha (laughing) I do not have the bucket anymore, it broke because I was using it for cleaning the house” (In-depth interviewee ward committee member)

The rake we are using it for gardening and honestly I did not know what it was for, I have never used it for emptying the toilet.

“The rake helps me a lot when gardening of cleaning my yard” (Focus group member).

The participants reported that as much as they were given some material but they were not given gloves and nose protector to ensure that when they empty the toilet they are protected from contamination and their health is not at risk.

“I never receive the gloves and the nose protector as well and it would have been much helpful because it would protect us from germs”. I use plastics to cover my hands but I do not cover my nose I just hold my breath”. (Ward committee member, in-depth interviewee)

The participants reported that they were given this material but it was not explained to them what they need to use it for.

“My child I would be emptying the toilet correctly if the education was provided for a longer period of time but one day was not enough.” (In-depth interviewee, ward councillor).

Health and hygiene education within the household:

The level of cascading of the information varied with the categories. The non-maintainer group reported that the information was not transferred to the rest of the family members by the recipients of the education.

“She just told us that some people talking about toilets came to look at the toilet and gave us a bucket and rake.” (Focus group participant).

However the maintainer group reported that the direct recipients passed on the information but not everyone reported that they had received it.

“She did admit that she had forgotten some of the things that she was taught... she only told us what she remembered... she did not do it the first day.” (Focus group participant).

Not even one among the participants, mentioned that the reason that they were provided with UDDTs was due to water scarcity whether they were maintaining the toilet properly or not. A

proportional number of participants did not know what the benefits of the UDDT were. This highlights the shortcomings of the health and hygiene education and the consultation process with the communities. Hence, a significant number of the participants reported that their ward councillor or someone with authority did not introduce the toilet to them.

“I would be lying if I say I know what the benefits of this toilet (UDDT) are, no one has ever told me” (In-depth interviewee, ward committee member)

Migration:

The migration was one of the common reasons that were reported by participants for not having knowledge on how to use and maintain the UDDT properly. The migration within the community was reported and some were coming from the outside communities where the UDDT was not used.

“I bought this house with this toilet so when I came to live here I had to operate my own way and I never thought of asking someone, I did not think it was important” (Focus group participant)

Main dislikes about the UDDT:

“There is nothing I dislike like emptying the toilet, having to look at all that dirt... I cannot eat the whole day after that.” (Focus group participant).

The participants agreed that the statement above was one of the reasons why they would prefer to have another toilet. The other related reason was that the UDDT had a shallow vault, so it filled up quickly and they were forced to empty the toilet two times a year. Some reported emptying the toilet three times in one year, depending on the number in the family.

The non-user category reported that they mainly did not use the UDDT, because they had to empty it.

“I would rather not start using it, because there is no one in my family who is prepared to empty the faecal matter.” (Focus group participant).

Toilet design:

The manner in which the UDDT was built came up a number of times in focus groups and interviewees, and this was one of the main reasons why people were not keen to accept it as a permanent asset. The participants mostly complained about how dark the toilet was inside and that the whole facility is too small

“You cannot move around, I find it really uncomfortable.” (Focus group participant).

The ISD consultant reported that the downside of the UDDT was that it was a fixed structure, and it would be great if people could move around with it if they move to a different area.

“People migrate now and again, so it is necessary to find a sanitation facility that they can move around with.” (In-depth interviewee, ISD).

Acceptance

The level of acceptance was very low amongst all participants. There was silence about UDDTs in the community. People did not talk about them except in community meetings where people would complain about UDDTs.

“I have never heard of anyone saying something positive about these toilets.” (Focus group participant).

Overall, the participants believed that the toilets were a temporary measure and that flush toilets were going to be introduced in their community in the near future. The data shows that UDDTs were viewed as something for the poor and that they feel undermined since the community authorities and other wealthy people in the community were not using these toilets.

“I really feel undermined, why are ward councillors not using these toilets, if they were so special?” (Focus group participant).

The participants reported that the toilets broke easily, especially doors, seats, and back covers. That made it even harder to accept these toilets.

“These toilets are cheap, the material used is cheap, and very few households have not had to repair or replace them.” (Focus group participant).

Utilisation of the UDDT:

Young people between the ages of 21 and 27 years were more welcoming about using the UDDTs and gave reasons why.

“I know that in the rural areas it takes a lot of money to install sewage systems and the topography is really bad for pumping of water.” (Focus group participant).

The other major factor was that children under 5 years were not encouraged to use the UDDT, because they feared that it was risky.

“These toilets (UDDT) risky, the children might easily fall inside, the seats are big. I simply tell my grandchildren to use the yard if they was to defecate, I know other people do it as well. I see neighbours children doing it as well”. (Focus group member)

Really how do you send a 4 year old in that toilet, they will fall in definitely”? (Focus group member)

The use of the UDDT at night amongst adults dwindled due to the distance between the toilet and the house. People felt it was risky to walk at night. The participants reported that at night they would use pots or other types of containers, and the urine was discarded in the yard in the morning. They would pour the faeces in the toilet.

Maintenance:

The cleaning and looking after the UDDT was the major reason that the participants reported for their reluctance to see these toilets as a permanent asset. The participants reported that they use a wet cloth or mop when cleaning the floors, urinary, inside and outside of the UDDT instead of the damp cloth. The participants also spoke about cleaning the inside of the seat with wet cloth because it normally has hard faecal stains that are you will need a wet cloth to easily remove.

“I use the mop to clean the toilet (UDDT), it takes away the stains easily. In the water I put handy any or any kind of soap that I have so it smells good after cleaning” (Focus group participant)

“Some people use the toilet any how when defecating they leave marks all over and cleaning and to remove that I use something wet sometime, I have to pour a little bit of water mixed with domestos so that it will peel off easily”. (Previous education facilitator- in-depth interviewee)

One of the major reasons was that the user had to empty the toilet:

“Who would like to see their waste? These people do not think we are human as well.” (Focus group participant).

The lack of information was also the reason why most toilets were not properly used and maintained. One of the study questions asked the participants to recite how they used and maintained their UDDT. Many participants reported that they did not pour the soil after defecating, but did it once a week when they were cleaning the toilet. Many households did not even have a bucket with soil or ash inside the toilet. As a result a large proportion of the participants despite whether they were in the maintainer or non-maintainer group, they complained of the bad odour.

“We are using the bucket for other things in the house, so we only pour soil when we are cleaning the toilet which is normally on Friday afternoon.” (Focus group participant).

“These toilets are very smelly as well, they are just not nice to use”. (Focus group member)

The burying of the faecal matter after emptying was also a challenge because many reported the content is usually wet, heavy and very smelly. This was due to various actions of poor maintenance that the participants reported they were practising (1) not pouring the ash or soil after every defaecation (2) using wet cloth and sometimes mix water with little bit of detergent which was normally referred as domestos to clean faecal matter marks that are difficult to remove when cleaning the inside and outside of the toilet and the urinary (3) putting detergents like domestos inside the vault to dissolve the smell (4) with the broken vent pipes the rain at times gets inside the vault.

“I do not like burying the faeces because it is a hard job, faeces are heavy and smelly, so it one job I wish I did not have to do”. (Focus group member)

When cleaning the toilet, a large proportion reported that they poured detergents inside the toilet to kill the bad smell and this was reported even by the previous education facilitators.

“I normally buy “domestos” or “handy andy” to pour inside the toilet, it takes away the smell.” (In-depth interview, previous education facilitator).

Hygiene:

The distance between the toilet and the yard tap discouraged the washing of hands, and even when they washed their hands, there was usually no soap around.

“If we leave it next to the tap, children will misuse it and it cost a lot of money, we can’t afford that.” (In-depth interview, ward committee member).

Soap was a valuable resource. They normally bought ‘sunlight’ bar soap that they used for washing clothes and bathing. If they also used it for washing hands, they believed the soap would be used up quickly and not last as long as they wanted it to.

“We cannot afford to wash hands with soap, because it is expensive.” (In-depth interviewee, ward committee member).

Characteristics of each category:

The common issue amongst all categories of respondents was that they all aspired to have a flush toilet. The information gathered revealed that the households that were maintainers had more children at home than the rest, see Figure 9. In the maintainer households there was more teamwork concerning the chores compared to the other categories; the family shared household chores. They alternated in cleaning the toilet and this referred to keeping the floor, toilet seat inside and outside clean and this is to be done with the damp cloth to avoid water from getting inside the vault. The urinary is also to be cleaned using the damp cloth. Compared to the non-maintainers most of whom reported that the toilet was the responsibility of one person in the household. The people that had directly received the health and hygiene education during the

UDDT roll out were still living in the household and were younger. In contrast, most of the direct recipients of the health and hygiene education in the non-maintainers group were no longer in the households, and had either died or migrated.

Chapter 5: Delivery of the health and hygiene education (HHE)

Background:

This section of the study looks at the HHE that was developed using the findings of this study to improve on the EM previous HHE using what were gathered to make it relevant. The data gathered from the questionnaires about the use of the UDDT were used to develop questions for the focus group discussions and in-depth interviews. These questions aimed to gain a deeper understanding as to i) why they were using or not using the toilets, ii) why they were maintaining or not maintaining the toilet, iii) if they had accepted the UDDT, iv) and if not, what it would take for them to accept them? Thereafter the data gathered was used to develop education material which was subsequently implemented in two rural communities.

Upon implementation of the health and hygiene education, a follow up survey was conducted to understand the state of the UDDT. A standard checklist was used as an evaluation tool to assess the effect of the education programme after an appropriate period of time. The health and hygiene education was implemented in two of the study areas namely Zwelibomvu and Lower Maphephetheni, but the eHlanzeni area was not included due to time constraints. In these two areas the health and hygiene education was implemented from March to May 2014. In that time period four schools (two high schools and two primary schools) were visited in each area. At Zwelibomvu the research team worked with three community groups namely two women's groups, and one community caregivers' (CCGs) group. At Lower Maphephetheni the team worked with two youth groups, two women's groups and one CCG group. It was vital to involve the school children in the education, because the findings indicated that the children that were involved in the maintenance of the UDDT wanted to be a good example to their younger siblings in terms of how to use and maintain the toilet properly.

The community groups comprised of people that were influential in the community. If they were using their toilets properly and talked positively about the UDDT, the negative attitude might change to a more positive one. The community care givers (CCGs) were individuals that were hired by the Health Department. Their job was to visit households daily to educate them about health and hygiene, and also to care for those that are sick. The intention was to make them aware of how the UDDT worked and how these toilets impact on health and hygiene, so that the CCGs could keep reinforcing the information in the community. The inclusion of Community Care Givers (CCGs) was deemed necessary, since they would help re-inforce the training and information that the community members received. They would also emphasise the health risks posed by bad sanitation practices.

Themes addressed by the health and hygiene education:

The findings of this study were grouped into themes that were used to develop direct and relevant messages for users of the UDDT. The themes were developed during the process of the content analysis, and the health and hygiene education was informed by the findings of this analysis. Below are the themes that the current health and hygiene education was developed to address.

Role modelling:

A large proportion of participants was unhappy about using the UDDT, mainly because the authority figures in the community were not using this. Instead they converted the UDDT to a flush toilet. This act created a perception that it was not an ideal toilet and that it is for the poor, because those that could afford changed it to what they viewed as an ideal toilet (i.e. flush toilet). The targeting of people in the community structures was one way in which this theme was addressed, because if they were positive about the UDDT and using it properly, it could have the desired effect on the users. In the workshops, the community leaders were reminded of their influential positions and the need to keep using the UDDT properly, and the impact that this could have in the community and the eThekweni municipality at large.

Communication breakdown:

The health and hygiene education provided previously by eThekweni Water and Sanitation officials was rendered during week days between 9:30 and 15:30. The facilitators in most cases only met one member of the family and this person would then be entrusted with the responsibility of cascading the information to the rest of the family. However, during this research study, the campaign visited households over the weekend when most people were not working and the children were not at school. The aim was to meet as many people in the family as possible, so that all users get the information first hand and could all hold each other accountable.

Perceptions about the UDDT:

Among the topics covered by this health and hygiene education were i) water scarcity, ii) environmental issues, and iii) the benefits of the UDDT. This clarified that provision of the UDDT had nothing to do with the class of the people, but it had everything to do with preservation of the environment, specifically water.

Children clean the toilet:

Involving schools was one way of reaching out to the children, since they were playing a significant role in maintaining the UDDT. Therefore, it was crucial that they were furnished with information that would help guide and shape their perceptions and behaviour in the use and maintenance of the UDDT.

Poor maintenance:

The content of the education addressed poor maintenance by giving users a thorough understanding of the steps that needed to be followed in order to effectively maintain the UDDT and provided detailed information about the benefits of doing so. The appropriate equipment like gloves and nose protector need to be provided by EM for the users so their health will not be jeopardised when doing the emptying job. The other option is that it can be provided once by EM and the equipment can be made available in the local warehouses at a rate that is reasonable. This also looked at other alternatives that are there since the study and the EM did not have a budget to provide this at the time of this study. So we had to explore other options like using plastics when emptying the faecal matter.

The content of health and hygiene education:

The selection of content and development of health and hygiene education material was informed by themes that emerged during the process of data analysis. The topics in the health and hygiene education included i) the challenge of water scarcity, ii) hand washing, iii) the contamination cycle, iv) benefits of the UDDT, v) maintenance of the UDDT, and vi) methods of operating the UDDT.

The education took topics that mostly seemed technical and simplified them so a lay person could understand them. The material used to deliver the message also played a major role in ensuring that the message was communicated in a manner that the community could understand.

The role of the previous EWS education material:

The lessons from the previous health and hygiene education resulting from the findings of this study were used. It was learnt that in the majority of households, the information was not cascaded to the rest of the family members, and in some cases, not all the information was communicated. Therefore, with the updated version of the health and hygiene education, the team wanted to involve as many family members as possible in each household. That is why it was only implemented at the weekends, when most people are at home. The findings also indicated that the children were involved not just in the usage, but in the maintenance of the UDDT as well. Therefore, they needed the information just as much as adults. As a result, in

each of the two areas four schools were visited, two primary and two secondary schools in each area.

The role of the literature:

The information obtained from the literature was used to understand what was being done internationally in terms of health and hygiene education. The information gathered was used to inform the material and the approach used to deliver the education.

Development of training manuals

The manuals worked as a step by step guide for the facilitators. They contained activities that the facilitators had to implement, and the content that they needed to highlight and emphasize. The content of each of the three manuals was to be implemented in a one-day workshop. The different vehicles of delivering the message for different age groups or target groups but the same content was covered to ensure uniformity since whether young or old the users need to carry the same information. Since the findings showed that the children were partook in the cleaning of the UDDT and they are users as well so they need to hold the same information as the adults so that all family members are accountable to each other and they are able to remind each other on how the UDDT it so be used and maintained. Manuals were developed differently for different groups namely school, households and community members (see appendix J) and they all covered the content on (1) **water scarcity**: alluding to reasons why the UDDT was chosen by EM (2) **hand washing**: how to wash hands properly and the importance of it (3) **contamination cycle** ; starting from how to keep the flies at bay if the UDDT is used properly, that is the doors and the toilet seats are closed at all timed and if the items broken are repaired timeously with correct material (4) **benefits of the UDDT**: the suitability of the toilet for the environment and this also looked at other types of toilet their advantages and disadvantages, in the same topic the UDDT was dissected, looking at each time from the door, to mesh, vent pipe, shallow vault etc. in this section it was to dispel the perception that the UDDT was built for the poor but it was to help users understand that the UDDT was thought through (5) **maintenance of the UDDT**: this looked at how the toilet is to be cleaning (the video was played in halls and schools that had the facility) that demonstrating how the UDDT is to be cleaned but none of the households had the facility to play the video. This included emptying the toilet and to bury the faecal content. It also looked at the vaults are to be changes when the other one is full (6) **using the UDDT**: this looked at how users need to seat when using the toilet so that the urine or faeces will go to the correct hole.

Although the manuals were different, they covered the same content. They were different in terms of how the content was going to be delivered. The school manual and the community members' manual were more interactive compared to the household manual. However the household manual had an activity, where all family members available at the time were to sit together and talk about the benefits and proper ways of maintaining the toilet.



Figure 13: *Family doing an educational activity in Lower Maphephetheni*

Development of health and hygiene education material:

The education material was informed by the literature and the information gathered from the users. A consultant was sourced to help in developing the material, and the researcher provided a brief of how the material should look and the key messages to be addressed. The consultant was going to help in translating words into cartoons and print the material. The following material namely pamphlet, poster, comic book and video were developed. Figure 10 shows the all household members that were available at the time engaging with the education material to ensure that they all receive the information since they are all users of the UDDT.

Pamphlet (Appendix K)

The pamphlet was used in all groups and was distributed to community shops, ward councillors' offices and schools for all community members to access. The pamphlets mainly addressed the benefits of the UDDT, as it was evident from the findings that users were not aware of these. It also presented and explained the importance of each UDDT item, to encourage people to repair items timeously with the correct material, in order to keep the toilet functioning properly.

Poster:

The poster mainly addressed the cycle of contamination and emphasized the importance of washing hands after using the toilet. It also explained the effects of not engaging in this exercise, which include poor health and a contaminated environment. The poster was also distributed in schools and households.

Comic book: (Appendix L)

The comic book was only used in schools, because it aimed to educate how the UDDT was to be maintained and the consequences of not doing so in a fun manner.

Video:

The video was one minute in length and it covered mainly the challenge of water scarcity, how the UDDT should be used and maintained.

Approach used in delivering the education:

The method used to deliver the education was highly influenced by the Community Led Total Sanitation (CLTS) methods (Kar and Chambers, 2008). The language used was very direct, but not as crude as the CLTS suggest. The participants engaged in an exercise, where they were encouraged to conduct their own appraisal and analysis of open defecation (OD) and take action to become ODF (open defecation free) on their own. The participants were equal partners in the process, because the intention was not only to impart information but to gain information from them as well.

Education Area:

The education was implemented in only two areas, namely Zwelibomvu and Lower Maphephetheni which were part of the study. The reasons for choosing the two areas were that the research team had already built rapport with the authorities, and would not need to spend time developing new relationships. The other reason was that the study participants from those areas reported that they did not receive the education the way they were supposed to. Those who received the education did not pass it on to other members nor remember what they had been taught.

Sample size

In the two areas that the health education was rolled out, four schools were visited in each area (two schools were primary and two were secondary). In each Primary school the education was delivered only to the grade 5 and 7 pupils and at the Secondary schools the education was given to grade 8 and 9 pupils.

Households:

In each area 25 households were visited to provide the health and hygiene education and 193 individuals were reached. The households were only visited on weekends with the intention to reach as many household members as possible. In the house all the family members that were present were included in the education process, despite age. In the households the team mainly reached females of all ages and males were mostly of young age between 5 years and 12 years. The older males were normally not at home. In some cases they would leave the house and go elsewhere. If they attended, they would excuse themselves before the education was completed and said that they will obtain the rest of the information from the females. In all the 50 households that were visited, the least number of people reached in the household was three. Saturday was the day when the team managed to reach more people. The people were happier to welcome the team into their homes on Saturday than on Sunday. It took 45 minutes to one hour to conduct the session, but at times it went up to 1 hour 30 minutes depending on how interactive the family was and the size of the family.

Schools:

At the schools 583 pupils in total were reached. At school, health and hygiene were themes that were addressed in different subjects like biology, natural science and life orientation, but there was none that specifically taught about the UDDT or any other form of toilet. The sessions were 45 minutes long and the fewest number of pupils the team had in each class was 55. The highest number being 116. The children were welcoming of the education. They were excited to learn about what they used and had at home.

“Learning about UDDT makes me understand that they are important.” (Grade 6 pupil).

In schools the team was given one period to conduct the session, and that varied from 45 minutes to one hour.

Community workshops:

The health and hygiene community education workshops were three hours long excluding a 30 minute lunch break. In total 117 individuals were reached. The workshops were held in community halls since they were central and accessible to participants.

Training of research assistants to implement the health and hygiene education:

The research assistants were trained in January 2014, where they were taken through each manual and how they were to deliver the information to different audiences. It also emphasized again the importance of the researcher as a tool she/he, because they had great influence on how the education was going to be received.

Experience:

The health and hygiene education was well received by all participants namely school children, household members and the community structures. The participants recommended that the education be conducted on a regular basis, because they forget.

“You need to come back regularly, sometimes people forget how important something is as time goes.” (Community workshop participant).

This eludes to the fact that the education needs to be provided on a regular basis to all community members, especially the children in school because they are the future users of the toilet. The data showed that they were active participants in the cleaning of the toilet. The people were amazed at the information that they received. The participants were fascinated mostly about the fact that South Africa is one of the water scarce countries and the consequences of that. This helped to clarify the reasons for introducing the UDDT. The participants also found the activities exciting, because they were prompted to discuss other issues. However, it was not comfortable for some because it was an unusual conversation. The roll-out of the health and hygiene education was a success because the target population was reached and they understood the information provided as it was conducted in their own language isiZulu, by trained personnel.

Theoretical framework: Symbolic Interactionism

Low acceptance Diagram 1 below seeks to summarise the factors contributing to low acceptance of the UDDT, and some of these factors have been reported in this thesis. This diagram is in the discussion section because it broadly looks at the factors contributing to the low acceptance of the UDDT as per the report from the participants.

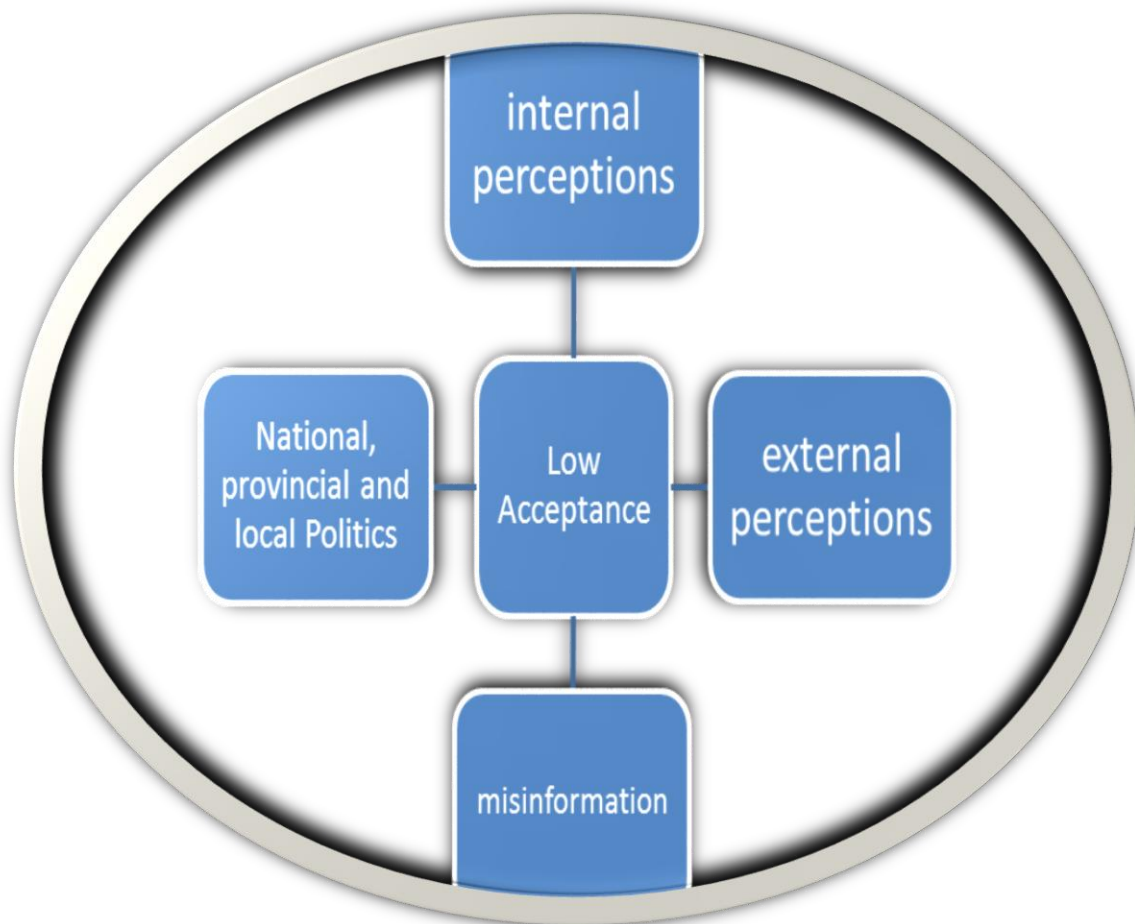


Figure 14: Contributing factors to low acceptance of UDDT
(Source: Created by student from study findings)

This diagram was used by the student to summarise findings in the light of the theoretical framework of Symbolic Interactionism used in this study (Mkhize et al., 2016). **Internal perceptions:** this refers to the perceptions, attitudes and behaviours that people held and employed in relation to the UDDT. Users perceived these toilets to be of lower quality and that they mostly were not designed with their reality and preferences in mind. The latter made users feel that these toilets were a symbol of being undermined, since they represent the poorest of the poor. Users shared these thoughts in the focus groups and in-depth interviews thinking they were the only ones feeling that way. In focus groups, they were surprised to learn that others also felt the same way. All of these factors contributed towards low acceptance of this toilet.

External perceptions: The participants reported that the community leaders were not using the UDDT, but instead converted them to flush toilet. This act re-enforced the perception that it was not an ideal toilet, and it was for the poor because those with money changed it to what they viewed as an ideal toilet (i.e. flush toilet).

Misinformation: the health and hygiene education was provided by EWS when the toilets were installed. However, people demonstrated very little knowledge about the toilet in terms of how it operated, was used and maintained. Many users reported that they did not receive the education. Users also reported that they were promised free houses and sanitation and therefore expected flush toilets, and no one told them about these (UDDT) toilets. People interpreted those promises of sanitation from the community leaders to be provision of flush toilets.

National, provincial and local politics: the leaders, and decision makers lived a life that people aspired towards. The people believed that since they put these leaders in power, the least they could do was to uplift the communities to the same standard of living as the leaders. The UDDT was not perceived to be in line with latter. It told the users that they were neglected, and that the promises made to them by the leaders were nothing but lies. So the people felt discontented, lost and hopeless about the future.

Discussion

The level of acceptance of the UDDT by users

The data collected from 120 households showed that the UDDT was used by 98% of the participants and this indicates the level of sanitation needs in the study areas which are rural in nature. Despite citing many negative aspects concerning the UDDT rather than positive aspects they still used it. The 60% of the participants did not maintain the UDDT properly, the participants whether or not they were maintaining the UDDT properly aspired to have a flush toilet, which was an indication of the low acceptance of the UDDT. The main reasons reported were that people believed UDDT was a temporary measure and would soon be changed to a flush or septic tank toilet. The latter thinking was propelled by the view held by the participants that the UDDT is for the poor and therefore no one wanted to be associated with it. The participants associated the flush toilet with being a first class citizen which in the study that was conducted by Austin and Duncker, (2005) that was done in South Africa, investigating the attitudes and perceptions of people in rural settlements towards the acceptability of using of human excreta for food production. Another contributing factor to the latter was the statements made by ward councillors since they were not in line with EM policy that the UDDT is a permanent solution. The ward councillors were afraid that if they say UDDTs are permanent that it will start riots, so to defuse the situation they introduced the UDDTs as a temporal measure. Moreover, the ward councillors and the other rich members of the community converted their UDDT's to flush which emphasized the notion that the UDDT is for the poor.

UDDTs are not used anywhere in South Africa except for rural community of eThekweni Municipality in KwaZulu Natal province. The UDDT is a new concept in South Africa, the older participants preferred the VIP toilet to the UDDT because they were accustomed to it, and it requires less responsibility from the user and very importantly the user does not have to empty it. The older respondents appreciated the VIP because the vault is deeper, the waste is far from the user and it takes a long time to fill up. The participants whether or not they were maintaining the UDDT properly but they still have negative things to say about this toilet.

The younger participants were accepting of the UDDT and they were able to recite information about the UDDT as they often mentioned the geographic and economic impracticality of providing flush toilets to rural communities and this understanding contributed to their acceptance. Moreover, the youth grew up using the UDDT as they were first installed in 2001. Therefore for most of these young people, the UDDT is all they know. Emptying is new to most users, because the VIP toilets that were used by many before the UDDTs were emptied by the municipality. So it did require a mind shift in what people understood as toilet requirements. Therefore education had a huge role to play in changing people's attitudes and behaviour about this toilet. However, people needed to understand that for proper maintenance of the UDDT, the faecal matter had to be in a dry state in order for the toilet to be safely emptied. The health concerns were another reason people were reluctant to empty their toilets, as they complained about not being given gloves and equipment to cover their mouth and nose. The EWS records Gounden et al., 2006 that the users were given gloves to protect themselves when emptying the toilet but the users reported that they did not get the gloves. However most

of the participants mentioned that they use plastic bags on to cover their hands when emptying because they do not have other hand protective equipment. The nose protector as well was another equipment that the participants would like to have when emptying the UDDT that the EWS did not provide.

Experiences of using the UDDT

Emptying of the toilet was one issue that stood out in all focus group discussions and in-depth interviews despite whether they were maintaining the toilet properly or not as the major reason why people were not happy with the UDDT. Emptying was another main reason that people felt that it was undermining to be expected to be in contact with the faecal matter because it posed a great threat to their health and some felt that it was just inhuman. The UDDT is a new concept for the users and because it was associated with being poor, resulted in resentment of the toilet. The former and the latter experiences were also reported by Wendland et al., (2011) in Europe and Central Asia. People there also felt that the UDDT was provided for the poor because the well-off families who build their own at times improve the UDDT model with which that they have been provided. Roma (2013) found in her study done in eThekweni that 8.4% had converted their UDDT to a flush or a septic tank toilet. The present study also confirmed that the ward councillors and the well-off families in the community converted their UDDT to a flush or septic tank toilet. The participants perceived the provision of this toilet as being demeaning by the government because they did not view the UDDT as an adequate service. The findings of Wendland et al., (2011) in Europe, central Asia and Caucasus are very similar to those in South Africa, where people were using pit latrine toilets before they were provided with the UDDT. As a result they want the UDDT to be built far from the household because they expect it to be smelly which is common with the pit latrine. The latter should not be the case if users are educated because they would understand that one of the advantages of the UDDT if properly maintained, is that it is odour free. However, the main difference is that in countries like India and some parts of Europe, the UDDT is also installed in schools and kindergarten which is currently not the case in South Africa, since none of the schools have the UDDT (Wendland et al., 2011).

A large number of participants reported that the UDDT was not comfortable to use because it was dark inside and the seats were not stable. The latter made people feel as though these toilets were not intended for them because many people in the community are big in structure and these toilets are small in structure and this could be the reason why the toilet seats break easily.

UDDT maintenance

The study sample comprised of 104 adult females who participated in the focus group discussions and the interviews compared to 42 male participants, and this worked in favour of the study, because this was the group that was mainly responsible for the maintenance of the household, including cleaning of the toilet. So they were directly involved which validated the

information they were sharing and they knew first-hand what they were talking about. The responses on cleaning the UDDT showed that there is a lot done that should not be and that the EM HHE advised against on paper. The participants reported in most cases they use a wet cloth or mop when cleaning the toilet on the outside and on the inside. The toilet on the inside normally has faecal marks depending on texture of the faeces so it hardens and the damp cloth is not suitable to clean. They reported that when the latter issue occurs they will mix little water with the available detergent or soap and they will pour it on the dirty area and they scrub it off. So in such instances the water will get inside the vault which could not be the case. Moreover the participants also reported that due to the bad smell that probably occurs due to faecal matter not drying because water keeps getting inside the vault when cleaning. Moreover, the findings show that vent pipe was one of the UDDT items that was found broken in most toilets so this allows rain inside the vault as well. The UDDT requires to have ash/ soil poured inside after every defaecation but the majority of the participants reported that they only pour soil or ash once a month when cleaning the toilet. It should be noted that findings reveal that children between 9-16 whether they are boy or girl they normally clean the toilet but this mainly found in the maintainer group. This would also have an impact on how much water the child will allow to get inside the vault when cleaning because they might not be able to control the excessive water on the cloth or mop like an adult would because the hands are not as strong.

The women are a critical group, because they have a major role in educating and monitoring children, on properly using and maintaining the toilet. Austin and Van Vuuren, (2001) also report that the latter is very common in Africa. The older people in the households, especially the females, were the ones that were responsible for emptying the toilets due to the belief that being in contact with the faecal matter brought bad luck. The older females would rather have that happen to them than to their children, because their lives were just beginning. When clarity was sought on this issue that was mentioned by very few people in the study they said by children they refer to their female children who are at the stage of getting marriage. So they believe emptying and being in contact with the faecal matter the UDDT might cause bad luck and end up not getting married. It was clear that the males did not participate in the cleaning of the toilet, but in a few instances older males did empty the toilet and buried the faecal matter. The latter was also reported by Duncker et al. (2007) that it is very common in Africa since males do not partake in the household chores even if they are not employed. The burying of the faecal matter was another big challenge since the UDDT was mainly not maintained properly so instead of the faecal matter to be dry (see Figure 15) it was wet and heavy. The latter was because the users mainly did not pour soil or ash after defecating as they are supposed to for the faeces to dry and odourless: this makes emptying easy. Tilley et al, 2014 state that it is advisable to pour ash, lime, dry soil or saw dust *after each toilet use* to encourage drying to minimise odour and to prevent flies. The poor maintenance of the UDDT contributed greatly on the low acceptance of the UDDT whereas if the users use and maintain the UDDT properly they will be able to see its benefits: the toilet will be odourless and there will be no flies.



Figure 15: Dry faeces from well-maintained UDDT in a period of one year

The participants complained about the quality of the UDDT material, as it was easily broken. The doors, toilet seats and back covers were some of the things that the participants reported to break easily in the UDDTs as seen in Figure 8. The users in most cases used unsuitable material to repair the UDDT because they did not have the money to buy the doors and pedestals. The participants questioned the quality of the UDDT items because they reported that the doors, seats, back covers etc. broke within a year of the installation of the toilet. The latter also perpetuated the feeling that the UDDT is for the poor and that they were given this type of a toilet because they are being undermined socially.

The design of the toilet was another concern, because users viewed the toilet as a place that should allow them to relax and even read. But, the fact that it was dark inside did not afford them that luxury. The light came from the top of the vent pipe, and it was insufficient. This was the reason why most people reported having to open the door when defaecating. This compromised people's privacy and dignity, when using the toilet. Furthermore, it perpetuated the cycle of contamination through flies even though darkness helps to keep flies away but this complaint should be taken into consideration one of the participants mentioned that you "cannot even read a book" so the EM need to explore that issue and see what they can best do offer users a comfort they are looking for. The shallowness of the toilet was another factor that people were not happy with, because it meant that they have to empty the toilet more regularly.

The study shows that 60% of the UDDTs were in a bad condition and this meant that the several items of the UDDT were either broken or missing (i.e. door, vent pipe, and pedestal) (see Figure 8). Furthermore, the items that were found to be broken or missing were repaired using unsuitable materials (see Figure 6). The participants reported that they did not have money to buy proper material due to the high level of unemployment and some complained that they have to go very far to buy these materials. It would make a great difference if the items of the UDDT were made easily available at a cost that people can afford.

Health and hygiene education

The low acceptance, improper use and poor maintenance could have been encouraged by the reported lack of education. The eThekweni municipality hired local people (facilitators) through ward councillors to provide health and hygiene education to all households that had the UDDT installed. The facilitators were not required to have metric but the councillors took anyone they deemed suitable but there was no standard criteria in place for the selection of these individuals who were to be tasked with such important and critical work. The work to educate all users on what the toilet is, how it works, how it to be used, maintained and emptied. The majority of the participants reported that they met the facilitators once when the toilet was installed. In this visit the facilitators had the task to educate users on all themes that they should have covered before the toilet is installed. So this could be the added reason why the users do not have information that will be regarded as basic on how to use and maintain the toilet. The facilitators reported that they received training once and by the time and by the time they give the education was after a month or two when the UDDT's were installed so it is likely that they were also did not remember most of the things that they were taught. The facilitators also did not have files with information so they did not have documents to help them remember was they were taught. This indicates that the monitoring that should have been employed by the ISD was very poor. The proper monitoring systems were not in place to ensure people do their visits and they give people education as required. The facilitators had to educate any person they found in the house during the visit and in most cases only old women are at home during the day and the recipient of the education will be given responsibility to relay the information to other family members. As a result a lot of participants reported that they never received health and hygiene education during the EM roll- out of the HHE. The participants report that they were visited once by the education facilitators only after the UDDT was installed.

The participants were excited when the health and hygiene education developed using findings of this study was rolled out because they began to understand why the UDDT was chosen, its benefits and the importance of using and maintaining it properly. The participants were requested to recite information they should have received when the UDDTs were installed but many reported that they did not pour soil after using the toilet and some used a wet cloth, some poured domestos and other detergents inside the vault to kill the bad odour. The latter acts will only make the odour worse but the participants would have known this if they had the information. They also reported that they cleaned the toilet with wet cloths and. Moreover, the participants reported that they were given the bucket, rake and cup, but it was not explained to them what they are for and how they should empty the toilet.

The education material was kept behind the toilet door, where it was dark once the door was closed. Nobody could read the material in the toilet, yet that was the convenient time to read what was written. It did not serve the intended purpose. Therefore, no one even realised that the material had been taken out, when it was not there.

UDDT use

The study shows that 89% of the participating households used the UDDT and this shows that despite the low acceptance of the UDDT the community need the toilet and they understand the importance of using the toilet. However, a large proportion of participants reported that they do not allow their children under the age of 5 years to use the UDDT because they fear that they might fall into the toilet. Instead the children are taught to practise open defaecation, which posed a health risk to the family, community and the environment, as the faeces of a child are as harmful as that of an adult. Although their fear was genuine, the children should be taught at a young age to use the toilet properly, so that they can grow up with the correct attitude and behaviour. Using a toilet is a learned behaviour that is better grasped at a younger age, and will potentially reduce open defaecation practices. The participants felt that it will be time consuming for children to use the UDDT because the parent / guardian will have to stop everything they are doing and monitor if they are sitting properly and that they are safe. The participants also reported that the children between 6 years and 9 years struggle to use the UDDT correctly because they are small and as a result the faeces goes in the front hole where the urine is to go and it blocks the toilet. The latter is one of the reasons why the small children are not encouraged to use the UDDT. Using the UDDT at night time was a challenge for many users since the UDDT is built far from the house, thus the users reported that they use potties at night and they throw the urine in the yard when its morning and the faeces are thrown into the toilet.

It is of great importance to take note that 11% of respondents were not using the UDDT. Rosemarin (2012) says that people need to be provided with choices and they need to partake in decision making because the main reason they gave for not using the UDDT was that they were not sure how to use it. The non-users who reported that they do not appreciate that they have to empty and bury the faecal matter, were using the self-constructed VIP toilet.

Maintainers versus non-maintainers

The study also looked at the factors that contributed to making the maintainers maintain their UDDT and what made the non-maintainers unable to look after their UDDT properly. The maintainers reported that when they work as a team in the household, they take turns to clean the toilet, whereas amongst the non-maintainers, it was a task given to one person in the household, mainly an old lady. Working as a team lessened the work load and encouraged people to do their chores effectively, because they were accountable to each other. The lesson is that people were able to look after the toilets better, if they shared the work. This did not make them feel exploited, which resulted in less reluctance in looking after the UDDT. In the maintainer group children played a vital role in cleaning the toilet which plainly involved cleaning the floors of the toilet, the inside and outside of the toilet seat and the urinary with the damp cloth. However the participants reported that they do this task suing a wet cloth which is not in line with the HHE. In the same group the direct recipients of the education

were younger in age and female, whereas in the non-maintainer group the recipients were mainly older and some had passed on. The younger better educated recipients are highly likely to pass on the information as accurately as possible, more so than the older counterparts. Hence the present study observed that the younger participants were more accepting of the UDDT than the older respondents, moreover the study observed that the younger participants had better understanding in why the UDDTs were installed which could be the contributing factor in why they are more accepting.

Hand washing

Hand washing was one of the core topics that the health and hygiene education communicated to the users, with a particular emphasis on washing hands with soap after using a toilet, emptying and burying the faecal matter to avoid spreading diseases. As a result soap was donated by UNILEVER and distributed to all participants in each household at the time of HHE roll-out of this study. Focus group and in-depth interview participants were given two soaps each to encourage the use of soap when washing hands after using a toilet. This suggestion was met with a challenge, in that soap was an expensive household item, and most participants felt that using it to wash hands was a waste. UNICEF, (2008) states that the tippy taps (see Figure 16) for hand washing in the rural areas because it is easy to make and it made out of available resources. The tippy tap can be erected next to the UDDT since the other challenge the participants reported was that the UDDT is built far from the house and even further from the tap, so this discourages washing of hands after toilet use. However, tippy tap or water alone is not enough soap should be used at all times when washing hands after toilet use.



Figure 16: The tippy tap image
(Source: <http://www.tippytap.org/the-tippy-tap>)

Education roll- out

The previous facilitators were interviewed about their experiences in giving health and hygiene education to the community at large. The facilitators felt that the challenge was that they were not equipped with the information and skills to do the job properly: they reported that they were given a one day training and they were never called in again to be re-trained. Some of the facilitators joined the team later and they received no training but relied on the previous facilitators to inform them on how the job is to be done. The quality of the facilitators does influence the outcomes and the effectiveness of the task at hand. The distance was another factor that the facilitators raised in that they were expected to visit each household five times but in some households they visited only once because of the distance since they could only walk. The users in the study that received the education intervention were happy to learn about the concept of urine diversion, why eThekwini chose the UDDT, and how this was meant to benefit them and their environment, if it was used and maintained properly. The participants found that having the information was encouraging because they now understand why the toilet was chosen, why it was built in that manner and how it is to benefit them. This highlights that people do not appreciate things that are imposed on them but they want to participate and make decision on things that affect them. The information was also provided to the influential structures in the community, mainly the community care givers who were hired by the Department of Health (DOH) to visit households daily to ensure that the households were keeping to health and hygiene. These structures would help re-enforce the messages and keep them alive in the community. This is an example and demonstration of the necessity for different departments to work together when necessary to achieve goals.

Water scarcity

The health and hygiene education developed out of this study included the section on water scarcity because preservation of water is currently a big issue in South Africa. KwaZulu-Natal is one of the five provinces that were declared as water disaster areas in 2015 because it experienced the worst drought. The sanitation of many urban residents of South Africa rely on water to flush their toilets where older toilets use 7 liters or more to flush but the new regulations specify that toilets should use 6 liters or less. The government has a responsibility to devise strategies to ensure that this scarce yet essential (water) commodity is preserved. Saving water is one of the key priorities for eThekwini water and Sanitation and South Africa as a whole and the UDDT is suitable since it is a waterless system. Mya (2011) explains that flush toilets are typically not designed to handle waste on site, their drain pipes must be connected to waste conveyance and waste treatment systems. When a toilet is flushed, the wastewater flows into a septic tank or sewage system and from there to a sewage treatment plant (Mya, 2011). The former and the latter shows that to provide and sustain a flush toilet system in the rural areas where it mountainous, rocky and has a difficult terrain

will be costly. South Africa need to invest in rolling out waterless toilets to other rural areas that are conscious of the environment like the UDDT but what we learn from this study is (a) thorough consultation with the community (b) health and hygiene education (c) provide variety of toilets to choose from should be high priority. The latter will ensure that the potential users of the facility understand the facility, will improve acceptable and will contribute in proper use and maintenance of the toilet.

Credibility and dependability

Credibility and dependability are crucial concepts in the qualitative and quantitative research because the information gathered and the results presented should be reliable and trustworthy because decisions are taken based on this information. The present study followed stringent and credible methods of sampling, recruiting, collecting data and analysis to ensure that the data is not biased. The data were collected using standard tools and questions to also ensure dependability. The groups were homogenous in nature meaning they were grouped according to whether they were maintaining the toilet well or not and if they were not using the UDDT despite having it their premises. This information was derived from the questionnaire which allowed us to categorise groups homogenously to encourage honesty and transparency. This worked well because the participants felt at ease in sharing their thoughts, experience and feeling about the UDDT. Moreover, all the participants took part willingly and the refreshments were provided in cases of the workshops but nothing was provided for the school participants and household participants in terms of food only soap (lifebuoy) was distributed. The facilitators or the research assistants were tertiary graduates and this worked for the study because they were able to grasp the concepts easily during the training and most importantly, the importance of their role as the interviewers. The student and research assistants used the same introduction in the interview sessions and this also assured that their understanding is the same which helps in avoiding bias. Triangulation is another method that was used to ensure credibility and dependability of the results as three different methods of data collection were used and this proved the consistency of the findings.

Transferability

Transferability refers to the degree to which the results of qualitative research can be generalized or transferred to other contexts or settings (Barnes et al., 1994). The data gathered from this study is transferrable because as much as the study was conducted in three rural areas situated in different parts of eThekweni municipality where the UDDTs were installed but the attitude and perceptions participants held were very similar. This gives an indication that since the UDDTs were only provided by EM in the relevant rural areas of eThekweni therefore if a similar roll-out procedure can be followed in other rural areas of eThekweni similar results can be expected. The latter indicates that the experiences of the users are similar which might results to similar attitudes and behaviour towards the UDDT. Moreover, this is confirmed by the study conducted by Roma et al. (2013) where 65 areas of eThekweni

were employed in the study to evaluate the use and condition of the UDDT and the results showed low levels of satisfaction.

Study challenges

The data collection in the three areas was planned to take four months see Table 5 below, but it ended up taking six months due to challenges we had on the ground and with the ethical approval of the study. The ethics took more than 6 months to be approved. To secure appointments with councillors to ask permission to work in the areas. The other challenge was identifying some of the households as we were using the areal map to randomly select but when we came to the ground some houses were not easy to identify. The latter unconvinced the study in terms of time because we had a certain number of households we needed to visit in each day but due to difficult terrain and not finding the correct house we would end up not reaching our target. The weather was another issue because at times it was very hot or rainy and this also affected the time frames of the study.

Table 5: Study work plan

2013	ONGOING : LITERATURE SURVEY	Activities	RESPONSIBLE PERSON FOR IMPLEMENTATION	ESTIMATED DURATION	TIME SCHEDULE					
					1	2	3	4	5	6
		<i>Develop data collection instruments</i>	Nosipho	1 and half month						
2014			RESPONSIBLE PERSON FOR IMPLEMENTATION	ESTIMATED DURATION	TIME SCHEDULE					
		<i>Compiling a training manual</i>	Nosipho	2 weeks	x					
		<i>Training of facilitators</i>	Nosipho	1 week	x					
		<i>Community entry</i>	Scelo and Nosipho	1 month	x					
		<i>Data collection</i>	Nosipho and facilitators	4 months		x	x	x		x
		<i>Transcribing</i>	Nosipho and facilitator	1 month					x	
		<i>Data management</i>	Nosipho	1 months						
		<i>Data analysis</i>	Nosipho	3 months						

	<i>Developing an education programme</i>	Nosipho	3 months	x	x	x				
2015	ACTIVITIES	RESPONSIBLE PERSON FOR IMPLEMENTATION	ESTIMATED DURATION	TIME SCHEDULE						
				1	2	3	4	5	6	
	<i>Health and Hygiene education programme implementation</i>	Nosipho and health promoters	4 months			x	x	x	x	
	<i>Write up of the draft report</i>	Nosipho	4 months		x	x	x	x		
2016	<i>Final report</i>		3 month						X	
2016	<i>Writing a publication</i>		6 months							

Conclusion:

The UDDT is a facility that can only be effective if the user (a) accepts it (b) use it properly and (c) maintains properly. The level of acceptance of the UDDT is very low as the study has shown mainly because of the responsibility it extends to the user i.e. emptying, burying the faecal matter, pouring soil after defaecation and its association with poverty. The latter issues arose because of (i) lack of consultation with the community in introducing the UDDT (ii) lack of health and hygiene education (iii) lack of good exemplary leadership at local level, (iii) lack of collaboration between the departments (i.e. EWS and Department of Health), (iv) lack of adequate quality of the UDDT provided, (v) as the result, the users demonstrated poor acceptance of the UDDT and (iv) migration played a role in the lack of retention of knowledge about the use and maintenance of UDDTs in the households. Lessons to be learnt from this study are consultation and education are key when introducing a new sanitation technology in the community. The education should make users understand why they have a UDDT instead of a flush toilet and promote benefits of the UDDT that are relevant to the users. Working as a team was key in properly maintain the UDDT. The education can be used to break the vicious cycle because the more the users poorly maintain the UDDT is the more they will not see its benefits and the more they will despise it and not accept it as an asset of their household. However the more the users learn to properly use and maintain the UDDT is the more they will see and appreciate its benefits.

The younger generation was more accepting of the UDDTs hence they were using the UDDT or exposed to it from a younger age. When the health and hygiene education was implemented properly, the communities were more likely to understand the context (water scarcity), under

which the UDDT was selected as the sanitation solution of choice. They were therefore more likely to accept the UDDT as the right solution. The health and hygiene education is vital and it needs to be provided on regular basis since migration is common in the communities and all sectors of the community need to be involved.

Recommendations:

Health and hygiene education and monitoring

When designing community intervention programmes, such as the health and hygiene education, migration should be taken into consideration. Communities are very fluid and plans should be put in place to intervene constantly in order to achieve success in a sustainable manner. The education should be provided continuously to the users of all ages. Monitoring programmes should be designed and rolled out to i) track the building and quality of the UDDTs provided and ii) monitor the implementation and quality of the health and hygiene education. The latter could be done through random checks and having people with relevant level of education to assess the work that has been done if it matches the plans. The CCGs could be trained to take on the role of continuously education people on health and hygiene issues in relation to the UDDT because they are employed by Department of Health to work in the community on daily basis. The EM will need to join forces with Department of Health and formalise this union so proper monitoring systems are developed to ensure the CCG's continuously get training to upgrade their skills on communication and update on new information and monitored. Households with children under the age of five years should be provided with child toilet seats, and in some areas this was the case. The health and hygiene education will need to be carried out on the weekends as the present study was able to reach more people on Saturday and Sunday so the use and maintenance of the UDDT will improve. One of the advantages of the UDDT is that it does not smell when used properly. It can therefore be constructed closer to the main dwelling and the household members can therefore use it at night. They would not need to walk long distances at night to use the toilet and this therefore reduces open defecation significantly. This should be included in the health and hygiene education. The health and hygiene education need to include practical examples on how to best use and maintain the toilet as like how they can develop a schedule for all family members to partake in maintain the UDDT to instil the fact that it an asset for all who live in the house.

The EM need to continuously urge the influential people and leaders in the community need to lead by example and use the toilets. This encourages the community as a whole to adopt positive attitudes about the intervention and could lead to a higher acceptance of UDDTs as a sanitation solution. People should not be pressured into using the toilets, whilst the leaders are not prepared to use them themselves.

The accessibility of UDDT material

The EM needs to recruit or subsidise a few local business people to stock the UDDT material like doors, seats, back covers etc. So that they are accessible to users and they do not have to travel far to get them and still pay for the car to deliver them which works out expensive for the users. The EM will also need to ensure that the local business people stock on the buckets, rakes and nose protectors so that people will also find them closer. The former and the latter will encourage users to repair UDDT toilets using the proper material. The EM will need to advise the distributors of these material to include do –it –yourself (DIY) manuals that clearly show how to install these product in a UDDT.

Roles and responsibilities should be clearly defined

There needs to be integration of services between the various departments (i.e. Departments of Water and Sanitation, Health and Education) in the municipalities with their roles clearly defined. The EWS could focus on i) consultation strategies with the communities, ii) construction and monitoring of the quality of toilets, iii) implementation of health and hygiene education at community level. The Department of Health would then focus on i) training CCGs on reinforcing the health and hygiene education, and ii) monitoring the use and maintenance of UDDTs, since the CCGs work with the communities on a regular basis. The Department of Education would work on training young people through the health and hygiene education as part of the Life Orientation Learning Area, perhaps.

There are a number of meetings held on a monthly basis to report on progress and problems in the programme which could be used to create synergy between these departments. Those meetings range from Municipal Programme Management Committee (MPMC) meetings that were held between the Public Service Commissions (PSCs), Consultants, CSIR (IA), DWAF ISD, Municipality, and departments. Other meetings include the District Sanitation Task Team (DSTT) held at district level and the Provincial Sanitation Task Team (PSTT) held at provincial level. This allowed for consistent and transparent reports from all levels of the programme

Ongoing consultation and engagement with local structures

EWS should review its community engagement strategies to ensure that communities are fully involved in the matters and decisions affecting them. Channels for dialogue between EWS, local leadership and community members should be reviewed and made clear to the public in order to foster transparent and honest dialogue between all the stakeholders. There should also be regular meetings between EWS officials and local leadership in order to create unison between the policies and the messages that are delivered in the communities. The EWS has used findings from different studies to improve on the UDDT design etc. The other issue that the local leaders should work hard at hand in hand with EWS is to build future UDDT's closer to the house so people would be able to use them at night.

The inadequate quality of some technical options highlighted

There were problems associated with the structure and materials used inside the UDDTs. In order to improve user experience and enhance user acceptance of the UDDTs, good quality materials should be used both outside and inside the toilets. Furthermore, it should be easy for the communities to access replacement materials, at low cost, should they need to repair or replace any of the items, such as the doors, pedestals, and/or pipes. The material to empty the toilet as well like the gloves, nose protector should be easily available at the spot that is affordable to users.

Hand washing with soap should be prioritized

Adequate water supply is crucial for hygiene purposes. New and innovative ways need to be devised on how hygiene can be maintained to ensure good health in a manner that preserves water. Health and Hygiene education should, among other things, focus on water preservation strategies, so that there is adequate water for hand washing, with soap, after using the toilet. The South African government need to implement and monitor regulations to make toilets that use little water. The EM need to include tippy tap information in the health and hygiene module so that people are informed of its importance and how to make it closer to the UDDT using sticks and plastic bottles. The latter will ensure that the users wash hands in a manner that saves water, after toilet use. The education should also educate communities on the importance of preserving ground water as a valuable water source, hence the use of shallow vaults on the UDDTs as a result.

Demand driven approach is working

Through awareness campaigns and other forms of hygiene education, communities are now realising the need for sanitation, as more people apply for sanitation facilities. Even though most of them are struggling to contribute, they still make a plan to ensure that they receive a sanitation facility in their yards.

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Appendix A: Published in Journal of water, sanitation and hygiene for development.

**Title: Urine diversion dry toilets in eThekwin Municipality, South Africa:
Acceptance, use and maintenance through users' eyes**

[Short title: Acceptance, use and maintenance of UDDTs]

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ABSTRACT

This study was part of the VUNA project aimed to develop an affordable sanitation system that produces a valuable fertiliser, reduces pollution of water resources and promotes health. Urine diversion dry toilets (UDDTs) simplify the on-site hygienisation of faeces and allow for nutrient recovery from urine.

Social acceptance is vital for the implementation of the UDDT because sanitation is only effective if the system not only provides a well-designed toilet and effective waste management, but also offers users a facility that caters to their needs and is sensitive to their cultural lifestyle. This study used qualitative and quantitative to investigate acceptance, use and maintenance of the UDDTs. Key findings indicate lower levels of acceptance of UDDTs among the elderly, who are accustomed to traditional pit toilets. The users aspire to own a flush toilet, perceived to be indicative of household wealth. A dominant concern was emptying the pit and the quality of the building material. Community interventions are required that will promote acceptance, understanding and encourage proper use and maintenance of the UDDT, and may need some technology modification. There is an urgent need for increased community participation to address users' perceptions, attitudes and behaviour concerning the UDDT.

Key words | education, focus group discussions, qualitative, quantitative, re-use, sanitation

INTRODUCTION

The VUNA project is a collaboration between the Swiss Federal Institute of Aquatic Science and Technology (Eawag), eThekweni Water and Sanitation (EWS), the University of KwaZulu-Natal (UKZN), and the Swiss Federal Institutes of Technology in Zurich (ETHZ) and Lausanne (EPFL) (Etter *et al.* 2015). The project was multi-disciplinary in nature and this study was part of the social acceptance component aiming to promote acceptance, proper use and maintenance of the urine diversion dry toilet (UDDT). The project is vital for South Africa because it is a water-scarce country and this compels the country to initiate and develop adaptive mechanisms for water conservation and wastewater management.

Lack of clean water and basic sanitation is a challenge to service delivery and to poverty alleviation and sustainable development. In South Africa, 15 million people, most of whom live in rural areas, have no access to basic sanitation. A census of the South African government in 2011 reported that approximately 1.3 million households in South Africa are without access to piped water, of which, the majority are black households (Stats SA 2011). Moreover, approximately 749,000 households in the country have no toilet system at all, while approximately 8,240,000 have flush toilets connected to a sewage system (Stats SA 2011). Consequently, both have serious health impacts. Baker & Ensink (2012) reported that access to sanitation can significantly reduce morbidity from helminth infections as 1.8 million people die every year from these diseases, the vast majority of whom are children under five. The Department of Water and Forestry DWAF (2006) advised that sanitation technology needs to be carefully chosen based on the permanence of the settlement, the technical aspects, financial costs, design, expectations and the environmental considerations. DWAF (2006) goes on to state that sanitation systems should protect the environment and not harm it.

One of the country's Millennium Development Goals (MDGs) aimed to halve the number of people who are without water and sanitation (SAMDG 2011). From scientific predictions, by 2050 South Africa will experience a progressive decrease of economically usable freshwater resources; the country thus requires innovative sanitation technologies that are sensitive to the reality of water scarcity (Roma *et al.* 2013). Drangert *et al.* (2002) and Austin & Van Vuuren (2004) emphasised that alternative waste management options are needed to re-conceptualise sanitation, from the 'drop-flush-forget' model to the protection of environmental pollution at source by means of 'drop and re-use' models. In South Africa, few studies have been undertaken regarding the acceptance, use and maintenance of such systems as the UDDT. This study

follows on the earlier studies undertaken in the rural areas of eThekwinini when the UDDTs were first installed, which contributed towards the design modifications over the years (Kvalvig & Ngcoya 2006).

PROVISION OF UDDT BY ETHEKWINI MUNICIPALITY

To respond to the urgent need, the eThekwinini Municipality (EM) in 2002 installed UDDTs in its rural areas (Roma *et al.* 2011). Gounden (2006) explains that the decision to opt for the UDDT was due to cost consideration and environmental impact compared to the flush toilet that people aspire towards, open defecation (OD) and the ventilated improved pit (VIP) that the community was using which was harmful to the environment. The UDDTs provide the following benefits: 1) waterless operation; 2) no odour when correctly used and maintained; 3) treated faecal matter is dry, odourless and less offensive; 4) does not attract flies or other vectors; 5) treated faecal matter is partially sanitised and safer to handle; 6) aboveground design or use of containers in belowground vaults makes emptying simple; 7) minimal risk of contamination of ground and surface water resources; 8) possibility of aboveground design facilitates construction in challenging environments; and 9) possibility of construction in close proximity to or inside of the home adds security and convenience for users (Rieck 2012).

The UDDT installation aimed to address the expansion of municipal boundaries from 1,366 to 2,297 km², encapsulating a population of 3.5 million. The new areas were rural or peri-urban comprising approximately 75,000 houses, 80% of which had no appropriate water or sanitation facilities (Gounden *et al.* 2006). EM is in KwaZulu Natal where there was a cholera outbreak between August 2000 and July 2001 with 105,389 registered cases and 219 documented deaths (Mudzanani *et al.* 2003). There was thus an urgency to implement the integrated water and sanitation project followed by health and

hygiene education and training (Roma *et al.* 2011). The South African constitution preserves a basic right to receive sufficient water, stating that ‘... *Everyone has the right to have access to sufficient food and water ...*’ (SA Constitution 1996).

The EM provides UDDTs as permanent assets of households and communities. However, the sustainability of the UDDTs is dependent on the users’ acceptance, use and maintenance. Jackson (2005) states that such systems are to minimise environmental and health risks related to inadequate and poor sanitation. The UDD toilet is a sealed unit so the groundwater is not impacted (Gounden *et al.* 2006). UDDT technology is based on the assumption that keeping urine and faeces separate destroys the disease-causing pathogens contained in the faecal matter over time, through a drying process (Tilley *et al.* 2014). From the municipal perspective, one reason for choosing the UDDT rather than VIPs is that VIPs demand mechanical desludging which requires expensive equipment that is vulnerable to failure, often cannot access the site and frequently cannot cope with the heavy sludge and solid matter found in the pit (WIN-SA 2006).

INVOLVING PEOPLE IN THE DELIVERY OF SANITATION

The sanitation policy of South Africa emphasises that sanitation is more than just the provision of toilets, but is a cohesive approach that embraces organisational, technical, financial, environmental, social and educational frameworks (DWAF 1996). McConville & Rosemarin (2012) emphasised that the latter can only be realised if people are part of proper planning and are involved in choosing the sanitation technology. It is only then that sanitation sustainability can be realised.

Providing people with toilets is insufficient since measures also need to be taken to ensure that people accept, understand and properly use and maintain

the toilet. Therefore, EM engaged in various steps to introduce the UDDT to the targeted communities; first, a buy-in was sought from the ward councillors (local leadership), and the local leadership then introduced this to their respective communities ((Kvalsvig & Ngcoya 2006). Moreover, health and hygiene education was provided before and after the installation of the toilet to systematically introduce the UDDTs as the new technology in communities, to ensure that the community accept and use the toilet properly. However, Austin & Duncker (2005) state that education methods should be inclusive in nature, and take socio-cultural aspects into account. According to Parker & Kindig (2006), communities are not illiterate, and to a degree they can attain, understand and process simple information provided in order to make proper decisions. Austin & Duncker (2005) concur with the latter since UDDTs require a higher level of commitment from users than do other forms of dry sanitation.

OBJECTIVE

The objective of this study was to explore the acceptance, use and maintenance of the UDDT.

METHODS

The study was undertaken using both quantitative and qualitative methods which allowed a process of triangulation, as questionnaires, focus group discussions and in-depth interviews were used to collect the data. Marshall & Rossman (1999) stated that triangulation is essential to check and establish the reliability and validity of the study.

Initially, a questionnaire was used and later focus group discussions and in-depth interviews were held. The study was undertaken in three peri-urban areas of EM, namely, Zwelibomvu (west), Lower Maphephetheni (north) and Hlanzeni (south). These areas were selected as representing different geographical areas of EM where the UDDTs had been installed. In each of the

three study areas, 40 households were randomly selected from an aerial map using the metro number which is allocated by eThekweni Water and Sanitation (EWS) to all households with a water or sanitation service. At each household a short questionnaire including a checklist was administered on the first visit to ascertain if the household was: 1) maintaining the toilet properly (maintainer), 2) not maintaining the toilet properly (non-maintainer) or 3) not using the toilet (non-user) (Table 1). This information helped in forming the subsequent focus groups that were homogenous in nature (either maintainer, non-maintainer and non-user group) and this was done to encourage openness and transparency. Each of the 120 households visited was represented by one adult family member in the focus groups. In total, 121 people participated because one household at Zwelibomvu was represented by two family members.

Table 1 | Categories used for grouping participants (n = 121) in the four discussions held in each of the three study areas in eThekweni

Category	Description
Maintainer	<i>This is the label that was given to households with the UDDT in a good condition, i.e., all items intact, e.g., door, vent pipe, etc. in place. The broken items are repaired using appropriate materials</i>
Non-maintainer	<i>This is the label given to households with the UDDT in a bad condition, i.e., it has broken items, and the broken items are either not repaired or repaired using inappropriate material</i>
Non-user	Households that have a UDDT but choose not to use it

In each study area, four focus group discussions were held consisting of eight to eleven individuals in each group. Purposive sampling was used in

selecting the key informants for the in-depth interviews as they were selected according to their involvement in the UDDT project, the position they hold in their community and their knowledge about the UDDT. The key informants who introduced the UDDTs to households were ward committee members, ward councillors and previous local facilitators. In total, 25 people participated. Short, open-ended interview schedules were developed for these in-depth interviews and focus group discussions to facilitate the discussions. Probing was used to elaborate and clarify the matters being discussed. All interviews and focus group discussions (FGD) were tape recorded, transcribed word for word in Zulu and translated into English while preserving the meaning by the researcher, who has experience in this area. The qualitative data were analysed manually through the process of content analysis, data were verified, categorisation of data was done, the categories were coded, and contrasts and similarities were identified and then the meaning was further explored. The study was approved by the University of KwaZulu-Natal (UKZN) Biomedical Research and Ethics Committee (BREC), ref: BE07/13.

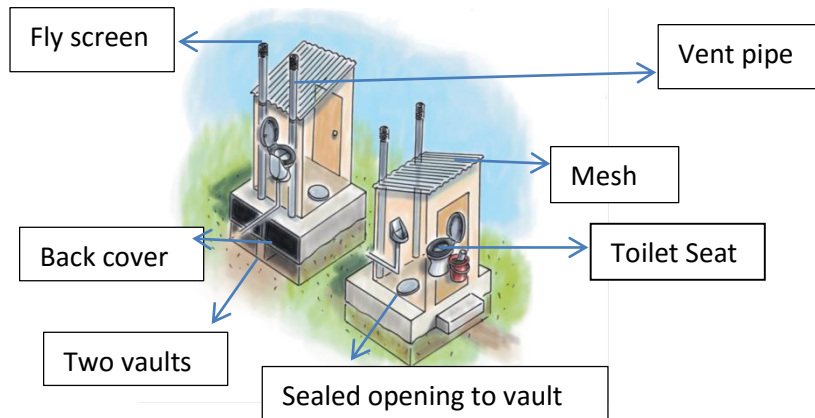
RESULTS

The results are presented in two broad sections. The first section contains findings from the brief questionnaire that was mainly looking at the condition of the UDDT. The second section comprises findings from the FGDs and in-depth interviews, and is divided into acceptance, use, maintenance and education.

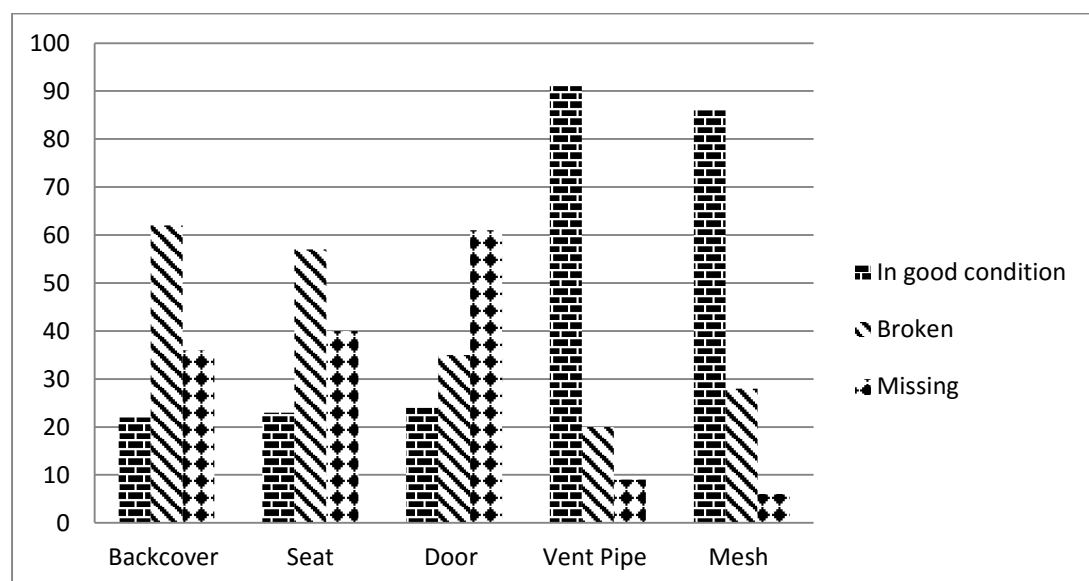
Condition of the UDDT

The quantitative findings revealed that of the 97% of households that were using the toilet, 80% were not maintaining the UDDT properly and only 17% maintained it properly. Households where the UDDT was maintained properly had more children.

Most of the UDDT items that were broken were the outside door, back cover at the vault and the toilet seat (Figures 1(a) and 1(b)). The mesh and the vent pipe were items that were intact in most cases.



(a)



(b)

Figure 7 | (a) UDDT showing different constituent items and (b) condition of UDDT constituent items (n = 120).

Qualitative approach

Focus groups and in-depth interviews

The data presented in this section were gathered from 146 participants, of whom 110 were female; their age varied between 21 and 65 years. For many households, the reason for the choice of the person to represent them in the focus group was that their nominee had no commitments on that particular weekend.

Acceptance of UDDT

Although the participants generally did not accept the UDDT (independent of the condition of the toilet), the younger participants were more accepting and they showed greater awareness as to why it was installed compared to the older participants, who often compared the UDDT to the VIP (ventilated improved pit latrine).

I do not have a problem with using the UDDT; I have used it ever since I can remember. (Female interviewee)

I am okay about using the UDDT because I understand why they installed it. (Male focus group member)

More than 95% of the participants reported that they do not regard the UDDT as a permanent asset and they all aspired to have a flush toilet, which is associated with being a first-class citizen.

I'm waiting for my flush toilet, there is no way that this toilet is permanent...I will not accept that. (Female focus group member).

The majority of the participants shared the view that the UDDT was the toilet for the poor.

Wealthy people convert these toilets to flush or septic tank, so only us who cannot afford are still using them as we were given. (Male interviewee)

The majority of the participants reported that they do not identify with the UDDT benefits, such as using urine as a fertiliser, or that the UDDT is cost-effective compared to the VIP toilet. Many did not concur as they felt that UDDTs are costly to maintain due to easily breakable items like doors and seats (Figure 2).

Pity is that many of us do not have gardens anymore and we are not even interested so I do not think this (UDDT) works for people. (Male who was a previous facilitator)

The door broke a few months after the toilets were installed...the seats are unstable because they are weak. We have people who are big physically. (Female interviewee)

The participants felt that the UDDT was not sensitive about their comfort since one has to be mindful all the time if your urine or faecal matter is going to the right place.

It is too technical, having to make sure that the urine goes to which hole, it takes away the comfort and peace that one should get when using a toilet. (Male ward councillor)

Additionally, participants reported that UDDTs are dark inside and this is the reason why most children do not close the door.

A toilet should be a place where I can relax and even read. (Female focus group participant)

A large proportion of people reported that they first heard about the toilets only a few days before the installation.

If only we were informed of this toilet before they installed them, maybe we would have asked them to give us something different. (Female interviewee)

Use of the UDDT

Despite the low level of acceptance, the UDDT was used by 97% of the participants, but many reported that it was not by choice.

We have no alternatives that is the reason we use this (UDDT). (Female interviewee)

The fear of allowing children between two years and five years to use the UDDT toilet was one of the highly discussed issues. The majority of the participants reported that they discouraged their children from using the UDDT and they practise open defecation instead. The main reason was the fear that they might fall, injure themselves or die.

So to be safe, I would rather they did not use the toilet until they are old enough...at least be 6 years old. (Female focus group member)

I tell my grandchildren to use the open space by our house to defecate because the hole of the toilet seat is big, it's risky. (Female previous facilitator)

Maintenance of the UDDT

Among those who were users, 80% were not maintaining the UDDT properly and only 17% were maintaining it properly.

The maintenance was one of the main reasons many participants dislike the UDDT and why others choose not to use it. Emptying the UDDT caused tensions in many households because it is a job that many prefer not to do. The findings reveal that the UDDTs are mainly cleaned by females in the household, and this includes the emptying of the toilet. A small proportion of respondents reported that the task to empty the toilet is done by older females because being in contact with faecal matter will bring bad luck to younger females.

They might end up not getting married if they do that dirty job. (Female focus group member)

Females end up cleaning and emptying the toilet because keeping the house clean is our responsibility. (Female focus group member)

We chose not to use the toilet because no one was prepared to empty it, so now we use it as the store room. (Male focus group member)

The participants reported that the toilets fill up quickly because the vault is shallow.

If they can make vaults bigger so at least I empty the toilet once in a year...now I have to empty twice a year. (Male interviewee)

The maintainer group reported that they worked as a team. They took turns to clean and empty the UDDT. Whereas in the non-maintainer groups, the chore to clean and empty the toilet was one person's responsibility.

It's better to clean it knowing that next week it will be someone else...so when it's your turn you want to make sure that you do not let other people down as well. (Female focus group member)

I get tired of cleaning it so at times I ignore it. (Female interviewee member)

Lack of UDDT education

A large proportion of the participants reported that they were not direct recipients of the UDDT education, in some cases other family members had received the information, and in other cases they had bought the house after the UDDT was installed. Subsequently, many participants blamed lack of education on how they use and maintain the toilet. However, what was observed from the

information gathered was that in the maintainer group the persons who received the UDDT information were younger, compared to the non-maintainer group.

We never received education. The people came once to our house telling us the UDDT will be installed tomorrow. (Male focus group member)

I bought the house with this toilet and the previous owners never explained to me, so we had to figure it out ourselves. (Female focus group member)

DISCUSSION

Acceptance

In this study, we explored the views and perceptions of the UDDT users in relation to acceptance, use and maintenance. The data show no direct relationship between the maintenance and the level of acceptance, because even those maintaining the toilet adequately still aspired to have their toilet changed from the UDDT to a flush toilet. The older generation preferred the VIP toilet because they are accustomed to it, it requires less responsibility from the user and mostly the user does not have to empty it. The older generation also appreciated the VIP because the vault is deeper, the waste is far from the user and it takes a long time to fill up. The younger participants also often mentioned the geographic and economic impracticality of providing flush toilets to rural communities and this understanding contributed to their acceptance.

Non-acceptance

The UDDT proved difficult to accept because it does not meet the user's perceptions regarding a 'first class citizen's standard of living and level of convenience'. Eales (2008) reported that poor South Africans (after the service discrimination experienced during apartheid) aspire to the same infrastructural services offered to the white population, which in this case is in-house flush

toilets and piped water. Households that could afford it were changing their UDDTs to flush, and this included their community leaders. This emphasised the perception that a flush toilet is for rich people and that the UDDT is a symbol of poverty. Roma (2013) found that 8.4% of respondents had converted their UDDTs to flush toilets. As discussed above, users reported many challenges with the UDDT that made it difficult for them to accept it. One of the benefits of the UDDT is the recycling of waste to be used as a fertiliser. However, in this study, users reported that this is not an incentive because very few people have gardens or are interested in gardening. Education and community participation will help EM understand what people's aspirations are and what they regard as benefits. Furthermore, repairing the UDDT makes it a costly asset that most cannot afford. Murray (2011) suggests that experts need to first establish which benefits will appeal to the community, and then the sanitation system design can be introduced based on this demand. A lack of consultation is one of the issues that was emphasised. EM reports that the community leadership was consulted and informed but users' reports disagreed; they explained that the information was not properly and timely provided. Consultation helps to provide accurate information, reduce negative perceptions and communicate expectations, concerns, fears and preferences of all those involved and this appeared to be lacking, thus more community participation is therefore necessary.

As reported by Matsebe (2011), emptying is one of the reasons that the UDDT is so unpopular with its users. It is one of the reasons reported in this study that perpetuates the perception that it is for poor people. Participants felt that cleaning the UDDT is unsafe for their health and makes them feel undermined, although the myth that being in contact with faecal matter brings bad luck especially to younger people was rarely reported. Inferior or incorrect design and construction of the UDDT was highlighted as a barrier to

acceptance. They felt that most of the community are big in body size and the limited space of the UDDT was inconvenient and that the toilet seat breaks easily. EM thus needs to increase the toilet size and to work with local businesses in stocking UDDT material that is durable, at a cost that people can afford. For the EM to respond to the desires of the users they will need to use a) education and community participation, b) to modify the UDDT by increasing the size and to allow more light inside the toilet and c) to use an alternative technology as more progress is made in developing models of ecological sanitation.

Use

The findings show that a large proportion of people are using the UDDT and this indicates that they see a need and the benefits of using the toilet. However, children under five years were encouraged to practise open defecation because parents fear that they might fall into the toilet. The participants reported that monitoring the child while using the toilet is time-consuming, but at the same time, they cannot risk sending the child alone into the toilet. Children's faeces are considered to be not as harmful as that of adults, thus not realising the health hazards this poses to the family and the community at large. Moreover, it is a lost opportunity to teach children at a young age how to use a toilet, so that they can grow up with the correct attitude and behaviour, since using a toilet is a learned behaviour. The 3% of the respondents who chose not to use the UDDT mostly objected to emptying the faecal matter, and this group continued using basic pit latrines.

Maintenance

Poor maintenance was indicative of the low acceptance and the perception that the UDDT is a temporary or interim measure. Although the majority of the participants were using the UDDT it was not their preferred choice and this

encouraged neglect of the UDDT. The doors, back covers and seats were reported to be items that easily break, which made people feel that they were given cheap toilets that were not customised to their reality. Additionally, McConville & Rosemarin (2012) found that users complain about the space, in that it was small and dark inside the toilet which made using the toilet uncomfortable. Future designs of UDDTs need to be of larger size and two layers of bricks may need to be replaced by a translucent plastic material so as to allow more light inside the toilet. Moreover, the EM in future will need to introduce other types of ecological sanitation facilities in order to offer communities a choice. The reason the UDDT was not maintained properly was because broken items were not repaired due to a lack of money and skills. In most cases, this resulted in the UDDT not functioning properly. The maintainers complained about easy breakages of the UDDT but they repaired the problem, whereas non-maintainers would repair inadequately (Figure 2) EM will need to ensure that suitable materials are used in the construction to reduce such problems.

The other maintenance issue was toilets that were full to capacity but the vaults were either not changed or emptied, and this is where the great difference occurred between maintainers and the non-maintainers.



Figure 2 | UDDT seat repaired inappropriately

The households where the UDDT was properly maintained had more children and they played a vital role in the maintenance of the UDDT. The latter suggests that children need to be involved when the sanitation technology is introduced because they are important in the use and maintenance of the UDDT. Children above six years of age use the UDDT toilet; however, the participants complained that children fail in most cases to urinate and defecate in the correct hole. Therefore, toilet seats that are suitable for children under five need to be provided and installed by EM after they have been checked and passed by the South African Bureau of Standards (SABS) for safety, so proper toilet use is encouraged from an early age. This study also revealed that females, both young and old, are mainly responsible for cleaning, but that emptying is mostly done by the older women due to the belief that being in contact with the faecal matter brings bad luck. This could be the reason why young people were more accepting of the UDDT than the older participants, since they do not have to perform what most people considered the worst aspect about the UDD toilet: the emptying.

Participants reported that most of the women are at home during the day, while men although unemployed were not at home and this had an influence on the division of tasks in the household. Drangert (2004) says this norm is seen mainly in Africa and it was also observed in Mexico. Moreover, as confirmed in this study, there were more females than males who participated and it was evident that most males did not participate in the cleaning of the toilet. Many studies look at the maintenance but they do not consider which methods work, as this study attempted to do. In exploring this issue, we found that in families where males and females work together as a team in looking after the toilet they manage to maintain it properly. Among non-maintainers where the task of

cleaning the UDDT devolved around one household member, this chore was undertaken with frustration and the toilet was not well maintained.

Education

The study found that many participants reported that they did not receive health and hygiene education from EM at the time of the UDDT installation because the direct recipients either did not relay the information to other family members, or they provided very little information. This suggests that relying on one member of the family to pass the information to other members, as EM previously did, is unreliable and there is a need to target the education to all or most family members, so that they all get first-hand information which increases the level of accountability. Moreover, some of the users were new household owners, who had bought the house with the UDDT and the previous owners never explained how to use it. This reality requires education to be provided on a regular basis so as to bridge the gap created by migration. However, in this study, the maintainer group was more informed about the UDDT than other groups and this suggests that keeping users informed will contribute towards proper use and maintenance of the UDDT. Health and hygiene education is one tool that can be used to actively involve the community, from planning to the implementation of the sanitation project, and this will ensure that the needs of the community are catered for.

CONCLUSION

This study has highlighted the lack of understanding about the use and benefits of the UDDT by many community members. Although the UDDT was used by 97% of respondents, there was a low level of acceptance and many aspired to have a flush toilet. Lack of education concerning the use of the UDDT was evident, as were problems with the quality of the UDDT materials. Community participation and provision of education about the use of the UDDT are

important strategies in changing perceptions about ecological sanitation in eThekweni. Moreover, the current drought in South Africa is a reminder that waterborne sanitation is not a feasible option; the emphasis needs to be on community participation and education to counter perceptions of an inferior product which will improve acceptance, use and maintenance of the UDDT.

ACKNOWLEDGEMENTS

This study is part of the VUNA project (www.vuna.ch) and has been financed by the Bill & Melinda Gates Foundation (Grant No. OPP1011603). I would also like to thank the VUNA team for their support. The EWS team, namely, Scelo Xulu and health promoters played an important role in the implementation of the project.

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First received 4 May 2016; accepted in revised form 18 November 2016.

Appendix B: Post-graduate letter of approval

13 July 2012

Student No:

Mrs NN Mkhize
C/O Department of Public Health Medicine

Dear Mrs Mkhize

MMEDSCI: "Promoting Sanitation and Nutrient Recovery through Urine Separation: The role of health and hygiene education in the utilisation, maintenance and acceptance of Urine Diversion (UD) toilets in the rural communities of kwaZulu-Natal (KZN)." Department of Public Health Medicine

I have pleasure in advising you that at a Postgraduate & Research meeting held on 25 May 2012, it was recommended to the School Board that you be accepted as a candidate for the above degree to be supervised by Dr M Taylor, **Public Health Medicine**. This will be ratified at the next Postgraduate and Research Committee Meeting.

Please call me on 031 2602834 at the Postgraduate Office at the School of Nursing & Public Health, 4th Floor, Desmond Clarence Building to discuss the steps involving finalisation of your registration.

Please ensure a full protocol is submitted to the Postgraduate Office within six months of registration.

I trust that your research will be both stimulating and productive, and wish you success in this venture.

Yours sincerely



Mrs Devi Arumugam
Postgraduate Administration

c.c. Prof M Taylor

Studies may not begin without Postgraduate and Ethics approval.

Appendix C: Ethics approval



03 October 2013

Dr. NN Mkhize
Department of Public Health Medicine
Nelson R Mandela School of Medicine
University of KwaZulu-Natal

PROTOCOL: Promoting Sanitation and Nutrient Recovery through urine separation: The role of health and Hygiene education in the Acceptance, Utilisation and Maintenance of Urine Diversion (UD) toilets in the rural communities of KwaZulu-Natal. REF: BE073/13.

EXPEDITED APPLICATION

A sub-committee of the Biomedical Research Ethics Committee has considered and noted your application received on 14 March 2013.

The study was provisionally approved pending appropriate responses to queries raised. Your responses dated 03 October 2013 to queries raised on 27 September 2013 have been noted by a sub-committee of the Biomedical Research Ethics Committee. The conditions have now been met and the study is given full ethics approval and may begin as from 03 October 2013.

This approval is valid for one year from 03 October 2013. To ensure uninterrupted approval of this study beyond the approval expiry date, an application for recertification must be submitted to BREC on the appropriate BREC form 2-3 months before the expiry date.

Any amendments to this study, unless urgently required to ensure safety of participants, must be approved by BREC prior to implementation.

Your acceptance of this approval denotes your compliance with South African National Research Ethics Guidelines (2004), South African National Good Clinical Practice Guidelines (2006) (if applicable) and with UKZN BREC ethics requirements as contained in the UKZN BREC Terms of Reference and Standard Operating Procedures, all available at <http://research.ukzn.ac.za/Research-Ethics/Biomedical-Research-Ethics.aspx>.

BREC is registered with the South African National Health Research Ethics Council (REC-290408-009). BREC has US Office for Human Research Protections (OHRP) Federal-wide Assurance (FWA 678).

The sub-committee's decision will be RATIFIED by a full Committee at its next meeting taking place on 12 November 2013.

We wish you well with this study. We would appreciate receiving copies of all publications arising out of this study.

Yours sincerely

Professor D.R. Wassenaar
Chair: Biomedical Research Ethics Committee

Professor D Wassenaar (Chair)
Biomedical Research Ethics Committee
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Website: <http://research.ukzn.ac.za/Research-Ethics/Biomedical-Research-Ethics.aspx>
Running campuses: Edgewood Howard College Medical School Pietermaritzburg Westville

INSPIRING GREATNESS



Appendix D: Household Visit: Recruitment Checklist

User	<input type="checkbox"/>
Non-user	<input type="checkbox"/>
Non-maintainer	<input type="checkbox"/>
Maintainer	<input type="checkbox"/>

Date:

Name of the Moderator:

- Greetings
- Introduction
- Information about the study
- Ask for the older person

Explanation:

The visit is part of a research that aims to understand the use, maintenance and acceptance of the UD toilets. The household has been identified as one of the participants; with permission of the household elder (s) we would request to get one person within the household who is above 21 years of age who will represent the family and community at large in a focus group discussion where issues about the UD toilet will be discussed.

1. House numbercontact no.....
2. Who are we talking to? E.g. mother
3. How many people live in the house? No. of adults.....No of children.....
4. How long have you had a UD toilet?
5. Is the family using the UD toilet? Yes ☐ No ☐
6. How many UD toilets does the household have? other type.....
7. Who would you suggest represent the household in the focus group discussion?
..... why?
.....
8. What day of the week is convenient for the potential participant to attend the FGD?
..... Why?

Toilet observation

Checklist Observation:

- | | | | |
|---|-------|--------------------------|------------------------------|
| 1. Does the house have a UD toilet? | | | |
| 2. Does it look like it is being used? | YesNo | <input type="checkbox"/> | <input type="checkbox"/> |
| a. Does it have a door? | Yes | <input type="checkbox"/> | No <input type="checkbox"/> |
| b. Does it have a toilet seat? | Yes | <input type="checkbox"/> | No <input type="checkbox"/> |
| c. Does it have a urinary? | Yes | <input type="checkbox"/> | No <input type="checkbox"/> |
| d. How does it smell? | Good | <input type="checkbox"/> | Bad <input type="checkbox"/> |
| e. Does it still have the vent pipe? | Yes | <input type="checkbox"/> | No <input type="checkbox"/> |
| f. Does it have the urine pipe? | Yes | <input type="checkbox"/> | No <input type="checkbox"/> |
| g. Is the EWS poster pasted on the toilet door? | Yes | <input type="checkbox"/> | No <input type="checkbox"/> |
| h. Are the back covers still intact? | Yes | <input type="checkbox"/> | No <input type="checkbox"/> |

Comments:.....
.....
.....

Toilet observation

Checklist

- | | | |
|---|-------|--------------------------|
| 3. Does the house have a UD toilet? | | |
| 4. Does it look like it is being used? | YesNo | <input type="checkbox"/> |
| 5. Observation: | | |
| i. Does it have a door? | Yes | <input type="checkbox"/> |
| j. Does it have a toilet seat? | Yes | <input type="checkbox"/> |
| k. Does it have a urinary? | Yes | <input type="checkbox"/> |
| l. How does it smell? | Good | <input type="checkbox"/> |
| m. Does it still have the vent pipe? | Yes | <input type="checkbox"/> |
| n. Does it have the urine pipe? | Yes | <input type="checkbox"/> |
| o. Is the EWS poster pasted on the toilet door? | Yes | <input type="checkbox"/> |
| p. Are the back covers still intact? | Yes | <input type="checkbox"/> |

Comments:.....
.....
.....

Appendix E: Focus Group Discussions: Interview Schedule

General:

About the UDDT:

1. When were you first introduced to the UDDT project?
 - What was said about the UD toilet?
 - How was the project introduced? (information given)
 - How clear was the explanation? (Did you understand it immediately?)
2. What do you understand to be the UD toilet? Is that how your family and the community also understand it?
3. How did the UD implementation roll out in this community? What happened sequentially?
4. How do you feel about the UD toilet?
5. What do you like or do not like about the UD toilet? (pro's and con's)

Maintenance:

6. How do you maintain the UD toilet?
Probe: what informs it, is the education received or general knowledge?
7. Since the installation of the UD toilet has it filled up and what did you do?
8. How do you feel about maintaining the UD toilet? Why?
Probe: who is responsible for maintain the UD toilet at home?
In other toilets that you have had do you feel it is easier to maintain a UD toilet?
9. What do you feel is lacking in your knowledge about maintaining the UD toilet?
10. What do you think should be done with the faecal matter from the UD toilet?
11. How do you feel about the re-use of urine?

About health and hygiene education:

12. Please explain what education you received in relation to the UD toilets? How many times did they come to your house?
13. How did you feel about the UD toilets before and after the education? How does your family feel and the community at large?
14. Who received the education in your household, age, gender, education etc.? Was it the same person every time?
15. Please share how the facilitators presented the education? (time spent, time of day, was formal or informal, conversation or presentation)

16. Was it easy to grasp all the education information presented? Why? If not, what could have made it easy?
17. Please share how the information was cascaded to the rest of the family members?
18. **Probe:** how long after the education did it take to pass the information to other members of the family? With the whole family? If not, was it given the same way to all members? If not, why? Did the family member still remember everything that was said? How did you feel about the task?
19. How did other family members receive the information presented? Was the person presenting the information fully informed?
20. Was the information given relevant? Was it practical? Why?
21. Is the information shared with new members of the family and visitors?
22. Do you think the education rendered contributed in how you and the family are using, maintaining and perceive about the UD toilet?
23. What would you recommend to improve the education rendered about UD toilets?
24. What do you think about the community education through theatre?

Acceptance:

25. Do you consider the UD toilet as a permanent structure for your home?
26. Are there people who have built the UD toilets themselves? Closer to the house?
Why?
27. Have you made any changes to the UD toilet? **Probe:** What kind of changes?
28. What are the beliefs that people hold about the use and maintenance of the UD toilet?


Observations:

1. Do they still have the material that was given to them including the posters?
2. Visit toilets and make observations of how they have maintained the toilets and if they are using them at all.

Appendix F: **In-depth interview question guidelines**

1. Do you have a UDDT in your household?
2. What is your view of the UDDT? Why?
3. What good things or bad things you normally say about the UDDT? Who do you share those thoughts with?
4. Are you proud of this project in your community and do you express that to your community members?
5. Would you recommend the UDDT to any one close to you? Why?
6. What role did you play in UDDT project?
7. What do you feel about the health and hygiene education? Strengths, gaps and weaknesses?
8. How did you receive the education? Was it first hand or secondary? Do you think that made a difference?
9. If, received first hand, how did you relay the message given to you to other members of the household? Were you satisfied with how you passed it on? What were the challenges or what made it easier to relay it?
10. What made you accept or not accept the UDDT toilet as part of your household asset?
11. To your understanding what is the community's perception about the UDDT?
12. What are you doing to encourage the proper use of the UDDT?
13. What is being done about the community members who are not properly maintaining their UDDTs?
14. Do you think this sanitation technology can be a permanent facility for the community?
15. What would you choose between flush toilet and UDDT? Why?
16. Do you think the community education through theatre was useful?

Appendix G: Letters of Approval from Ward Councillors.



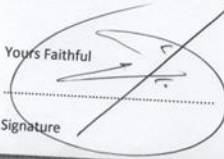
EThekweni Water and Sanitation
3 Prior Rd
Durban
4000

Re: Letter of Permission to conduct a study on Role of Health and Hygiene Education

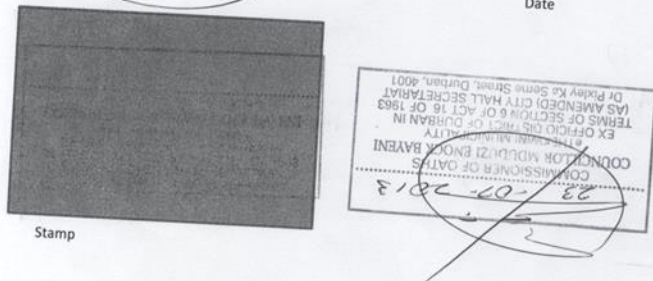
Dear Nosipho

Mduduzi Bayeni councillor of ward 99 give permission to
conduct a study in the eThekweni community. I have been informed; therefore I
understand that the study will entail visiting households and discussing issues pertaining to the use,
maintenance and acceptance of the UD toilet.

Yours Faithful

Signature 

Date 23/07/2015

Stamp 



EThekwini Water and Sanitation

3 Prior Rd

Durban

4000

Re: Letter of Permission to conduct a study on Role of Health and Hygiene Education

Dear Nosipho

I, Maxwell Mkhize councillor of ward 23 give permission to conduct a study in the Lower Maphahle community. I have been informed; therefore I understand that the study will entail visiting households and discussing issues pertaining to the use, maintenance and acceptance of the UD toilet.

Yours Faithful

[Signature]

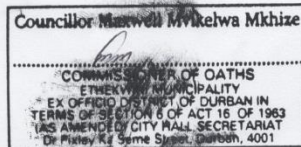
Signature

20/07/2013

Date



Stamp





EThekwini Water and Sanitation

3 Prior Rd

Durban

4000

Re: Letter of Permission to conduct a study on Role of Health and Hygiene Education

Dear Nosipho

I, MR M.P. MKHIZE councillor of ward 100 give permission to conduct a study in the Zwelonke community. I have been informed; therefore I understand that the study will entail visiting households and discussing issues pertaining to the use, maintenance and acceptance of the UD toilet.

Yours Faithful

Signature

Date



Stamp





EThekwini Water and Sanitation

3 Prior Rd

Durban

4000

Re: Letter of Permission to conduct a study on Role of Health and Hygiene Education

Dear Nosipho

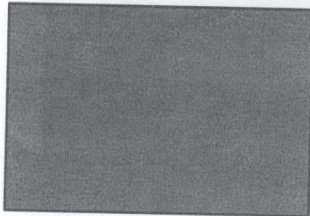
I, THAMI MAGUBANE councillor of ward 98 give permission to conduct a study in the EHLANZENI (UMHINI) community. I have been informed; therefore I understand that the study will entail visiting households and discussing issues pertaining to the use, maintenance and acceptance of the UD toilet.

Yours Faithfully

Signature

Date

23/07/2013



Stamp

Councillor Thami Magubane
.....
COMMISSIONER OF OATHS
ETHEKWINI MUNICIPALITY
EX OFFICIO DISTRICT OF DURBAN IN
TERMS OF SECTION 6 OF ACT 16 OF 1983
(A) CITY HALL SECRETARIAT
11 Durban Water Street, Durban, 4001

Appendix H: Information Letter for Participants

Dear Sir/ Madam

My Name is Nosipho N. Mkhize doing the Health and Hygiene education study under the University of KwaZulu Natal (UKZN). My contact details are as follows:

Tel: 031 311 8144

Email address: nosiphmk@durban.gov.za

You are being invited to consider participating in a study that involves research on the health and hygiene education that was provided in the urine diversion toilet roll out. The aim of the study is to explore the role that health and hygiene education played in the acceptance, utilization and maintenance of the UD toilets. The other focus of this research project will be looking at what worked, what did not work, the gaps that were identified during the health and hygiene education roll-out. The study is expected to enrol 120 focus group discussion participants in total, from three areas, each area will have 40 participants. The in-depth interview participants that will be recruited in four areas will have 40 in total, ten per area, the total of participants will be 160. The consultation with participants will be between 1 hour and 1 hour 30 minutes.

The study contains no direct risks but your participation in the study will help improve the future health and hygiene education programmes and how they are delivered to the community. The local authorities have been informed of the research study and have given permission for us to contact you. We therefore also request your participation in the project. In the project you are requested to participate as a key informant on the issues pertaining to the health and hygiene education programme rendered to your household. If you are willing to participate in an interview, an appointment will be made through consultation with you. The interview will be held within the community for your comfort and convenience.

This study has been ethically reviewed and approved by the UKZN Biomedical research Ethics Committee (approval number_____).

The selection was based on your relevance to the project's aim. Your participation will be highly appreciated.

If you need further clarification before making your decision please contact Mrs Nosipho N. Mkhize on the above contact details.

Yours Sincerely

Nosipho N. Mkhize

Appendix I: Informed consent for participants

Dear Participant

I have been informed about the study entitled *Promoting Sanitation and Nutrient Recovery through Urine Separation: The Role of Health and Hygiene Education in the Acceptance, Utilisation, and Maintenance of Urine Diversion (UD) Toilets in the Rural Communities of KwaZulu Natal (KZN)* by (Provide name).

Confidentiality will be maintained throughout the project. You will remain anonymous; your name and address will not be recorded or mentioned in the report that will be produced. You will not be identifiable. The information you share will form part of the whole body of information collected in the course of the project.

The tape recorder will be used only if you give permission to do so. The intention of using the tape recorder is to capture the conversation for proper and accurate documentation, so that we do not forget information shared.

Participating in the study is voluntary and you may withdraw at any point you want you have a right not to respond to questions that you are not comfortable with and you can cease the interview at any given moment if you do not wish to continue without any penalty.

There are no incentives for your participation in the project.

Disagreeing to participate in the project will not have any negative impact on your current rights and services as a citizen of South Africa and a resident of eThekweni Municipality.

If you **agree** to participate in the project please indicate by **signing** below (your name, signature and date)

Print Name

Participants Signature

Date

1. Witness Signature

Yours Sincerely

Signature

Appendix J: Training module for facilitators:



Health and Hygiene Education Programme for Promotion of Sanitation Product in the Rural
Communities of KwaZulu Natal

2014

How can I play a part?

Education is the most powerful weapon which you can use to change the world
- Nelson Mandela



Executive Summary:

Health and hygiene are an essential part of sanitation in helping understand what it about, how the product is to be operated which will encourage people to accept sanitation product. The health and hygiene education programme was developed to capacitate the stakeholders in the community to ensure that they understand the negative impact of the unhealthy practises on them, their families and the community at large. To increase awareness of good practises and the benefits of using the toilet properly and keeping it in a clean condition if their knowledge is increased.

Introduction: Let us know each other!

Ice-breaker:

Objective:

To know each other

Instruction: Ask your participants to introduce themselves and make three or four statements about themselves, one of which is false. Now get the rest of the group to vote on which fact is false.

Facilitator: to hang their false and true statements on the board for all participants to see.

Material needed:

Cards / paper, Koki pens, Prestick

Chapter 1

WATER AND SANITATION ARE NOT JUST SOUTH AFRICAN ISSUES!

Objectives:

- To introduced the topic
- To explore sanitation as a global issue
- To realise that South Africa and eThekwinini is committed in bettering their hygiene
- To understand the topic in relation to their community

Exercise: plenary discussion

What is sanitation?

Instruction: let the class discuss for few minutes and write down their responses down as they say them, at the end summarise.



Note: there is no wrong or right answer!!

Material needed:

News print, koki pen, prestick

Definitions

Sanitation is the hygienic means of promoting health through prevention of human contact with the hazards of wastes as well as the treatment and proper disposal of sewage wastewater.

The World Health Organization states that:

"Sanitation generally refers to the provision of facilities and services for the safe disposal of human urine and faeces. Inadequate sanitation is a major cause of disease world-wide and improving sanitation is known to have a significant beneficial impact on health both in households and across communities. The word 'sanitation' also refers to the maintenance of hygienic conditions, through services such as garbage collection and wastewater disposal.

Health is defined by WHO as a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity. It has not been amended since 1948.

Hygiene is defined as:

- Conditions and practices that serve to promote or preserve health
- Hygiene is the practice of keeping yourself and your surroundings clean, especially in order to prevent the spread of disease.

Health and hygiene of the UDDT:

Faeces contain pathogens that can cause a variety of diseases, including diarrhoea, typhoid fever, cholera and parasitic infections. Pathogenic species are infectious microorganisms that can be divided into four categories – viruses, bacteria, protozoa and intestinal worms; the latter is often referred to as geohelminths or soil-transmitted parasitic nematodes. The presence of pathogens in faeces is dependent on whether the person is infected with or is a carrier of the pathogen in question. Many pathogens are easily transmitted via the faecal-oral route, either directly, through contact of contaminated hands, or indirectly, through faecal contamination of food and water. Faeces borne pathogens are often spread by flies and other vectors.

Exercise: Is Sanitation only a South African problem?

Instructions: Write these in cards and have volunteers pick them out from a hat and read them out to the whole group. People should say what they think about that point shared. Write their responses on the newsprint.

Material needed:

Coloured cards or paper

Koki pens

Discussion:

Facts:

Did you know that in communities where a high proportion of people defecate outdoors, children are on average shorter than children living in communities where most people use toilets?

Of the world's population – 2.5 billion people – lack improved sanitation facilities, and 768 million people still use unsafe drinking water sources.

Inadequate access to safe water and sanitation services, coupled with poor hygiene practices, kills and sickens thousands of children every day.

Children – and particularly girls – are denied their right to education because their schools lack private and decent sanitation facilities.

Poor farmers and wage earners are less productive due to illness, health systems are overwhelmed and national economies suffer.

At the World Summit on Sustainable Development at Johannesburg in September 2002 the World Community committed itself to “halve by 2015 the proportion of people without access to safe sanitation”.

WHO data on the burden of disease shows that “approximately 3.1% of deaths (1.7 million) and 3.7% of disability-adjusted-life-years (DALYs) (54.2 million) worldwide are attributable to unsafe water, sanitation and hygiene.” In Africa and developing countries in South East Asia 4 –8% of all disease burden is attributable to these factors. Over 99.8% of all the deaths attributable to these factors occur in developing countries and 90% are deaths of children.

Children in the age range of 5 –14 are particularly prone to infections of round worm and whip worm and there is evidence that this, along with guinea worm and other water-related diseases, including diarrhoea, result in significant absences from school.

2.6 billion People, more than 40% of the world population, do not use a toilet, but defecate in the open or in unsanitary places.

A world of population growth and pressures on water resources within and among nations, sound and fair water management is a huge task and a clear imperative."

Exercise: Sanitation, health, hygiene and my community!

Instruction: divide the participants into groups and give them two or three points to discuss for 15 minutes or more. Each group will choose a person who will present their notes.

Material needed:

Pamphlet, Newsprint, koki pens and prestick

Point 1: what is the point of having a toilet in the yard?

Point: does having a toilet benefit me and my family?

Point 2: why were we given the UD toilet instead of any toilet?

Point 3: what environmental concerns do you have for you and your community?

Point 4: what is it that you do to contribute towards being healthy or unhealthy of the environment?

Point 5: what is it about the UD toilet that encourages healthiness and hygiene?

Point 6: does having a toilet closer or further from the house encourage hygiene?

Point 7: How can we contribute towards saving water and sustainable sanitation?

Group Work:

Draw a map of your community and pinpoint areas of unfavourable health. *“Community Profiling”*.

Chapter 2



My life, My community, My worldIt all starts with ME!

Objectives:

- To understand the national goals of water and sanitation
- To know and value their role in the water and sanitation goals

Outcome:

- so they fully understand why they have UD toilets
- they can hold each other accountable as the community
- encourage people to appreciate the sanitation product they have been provided with

Ice breaker: fruit salad

Instructions: Arrange chairs in a circle, leave 3-6m between the two rows for movement. Exclude a chair for yourself. i.e. There is one chair missing. Divide the team equally as one or the other fruit. Write different fruits in a piece of paper and let people choose what they want to be. If I call 'apple' then each person who is an apple must stand up and swop seats with another apple. The same applies if I call 'orange.' When I call 'fruit salad,' everyone stands up and swops chairs. The objective of the game is to sit down. The last person standing will be without a chair. This person then takes on the role of calling out apple, orange or fruit salad.

Caution: People can hurt each other in an attempt to get a chair. Make sure high heels are taken off. It can make a great discussion point

Materials

- * Chair per person
- * Enough space for movement

Activity 1:

Material needed:

Koki pens, Newsprint, pamphlet

Note: the intention is not that give you accurate answers but just to set the background and for people to understand the concepts.

NB: facilitator please consults your guide so as to answer questions accurately.

Definition:

What is water?

Answer: Water is a liquid at standard ambient temperature and pressure, but it often co-exists on Earth as a solid or gas.

Answer: Sanitation generally refers to the provision of facilities and services for the safe disposal of human urine and faeces

How does these two link?

Answer: Water and Sanitation is one of the primary drivers of public health

What constitutes an environment?

Answer: water, air, soil

Who is responsible for sustaining the environment?

Answer: those who use it i.e. human beings and animals.

Water can be an enemy or a friend

Clean water keeps our bodies clean and healthy whereas unclean water can carry diseases like cholera.



Internal and external environment are interdependent: (illustrating picture)

The body needs the external environment to be fully functional as the trees give oxygen and the human give carbon dioxide needed by trees to survive.

Activity2:

Material
Koki pens
Newsprint paper
Colour flash cards
Note:

Water and sanitation policy: points of discussion

- The major aim of national sanitation policy, and any consequent programme, is to contribute to improving the health and quality of life of the whole population.
- An estimated 21 million South Africans do not have access to adequate sanitation facilities¹. Those who have inadequate sanitation
- The inadequate excreta² disposal facilities mentioned above, combined with unhygienic practices, represent South Africa's sanitation problem. Often the unhygienic practices are related to:
 - a lack of access to health and hygiene education.

- The goal of Government is thus to ensure that all South Africans have access to essential basic water supply and sanitation services at a cost which is affordable both to the household and to the country as a whole.

The effects of sanitation problem:

- **health impact** - the impact of inadequate sanitation on the health of the poor is significant in terms of the quality of life and the education and development potential of communities.
- **economic impact** - poor health keeps families in a cycle of poverty and lost income. The national cost of lost productivity, reduced educational potential and curative health care is substantial.
- **environmental effects** – inadequate sanitation leads to dispersed pollution of water sources. This in turn increases the cost of downstream water treatment, as well as the risk of disease for communities who use untreated water.

eThekweni Water and Sanitation is part of the eThekweni municipality which is part of KwaZulu-Natal and part of South Africa, that is part of the African continent, that is part of the world.

I am just a small piece but that has a big role to play in saving water and supporting the??. Look at the realities of South Africa, number of people who are working and those who are not and how the system works in ensuring that we support those who are not working. Look at the environmental issues, what is happening and the responsibility we have in keeping things the same and how we can improve.

To illustrate how water and sanitation link back to the community and individuals. Ground water contamination....

Look at the rivers we have, the amount of rain against the population... what do we see in the future.

Illustrate the outbreak of cholera

Look at the cost of each toilethow fortunate that they have these toilets

Why these toiletslook at where the conversation is as far as sanitation is concerned

Thinking about now and thinking about the futurehow far would you go to protect the future of your children

Exercise : draw a sketch of the world you envision for your children and children to come

Is it a possibility?what would it take for us to reach this ...what would make this not come true?

Points to emphasise: that it all starts with me and I can make a difference and that we are all accountable to each other

Exercise: which toilet would you like to have, please draw or clearly define it?

Why do you think you do not have this toilet now?

What would it take to have this toilet...is it suitable? (have three toilets drawn)

Exercise for children:

Drawing and colouring
Story books

Example:

Health and Hygiene Arts and Crafts

Art

Yellow construction paper teeth, white paint and toothbrushes. Have children brush the yellow teeth with the white paint. Frame the completed 'smiles with red construction paper lips!

Art II

Group collage: magazine pictures of smiles. (Not whole faces, just mouths - any kind - human or animal!)

Sensory

Cut the bottoms off of large plastic soda bottles and turn them upside down - they look like teeth! Spray them with shaving creme and give the kids toothbrushes to brush the teeth clean.

Science

Scrounge some small white ceramic tiles (from construction sites, tile stores, parents who are remodelingetc). Provide children with a variety of food products to smear on the tiles such as: jelly, ketchup, syrup,peanut butter etc, have children brush the teeth with toothbrushes and real toothpaste. Which tiles are stained?

Making Toothpaste

Materials

- * 4 tsp. baking soda

- *1 tsp. salt

- *1 tsp flavoring(vanilla, almond or peppermint Extract)

- *toothbrush

- *floss

- *airtight containers

Mix together, put in containers. Dampen toothbrush and dip in mixture to use.

Good Food Collage

Make a "good food" for their teeth collage out of pictures from magazines. They might even want to hang them on their own refrigerator to remind them which foods are healthy.

Paper Plate Meals

Have the children look through magazines to find pictures of different kinds of foods. Then have them cut out the pictures and glue them onto paper plates to make 'breakfasts', 'lunches' or 'dinners'.

Pizza Collage

Materials Needed:

Round piece of tagboard

Glue

Red tempera paint,

Yellow & white Easter grass or yarn scraps
green, red, and black felt
brown scraps of paper

Procedure:

1. Mix red tempera with glue. Let children paint tagboard with red glue.
2. Tear brown scraps of paper and crumple them. Stick them to tagboard (sausage). Use green felt (peppers); red felt (tomatoes); black felt (olives); Easter grass or yarn (cheese).

Question:

What constitutes an unhygienic latrine?

UDDT :

Objectives:

- To show that there is lot of thinking that went to the structure
- To illustrate what each item in the UD is for
- To remind how it is be used to benefit positively from it

History:

Present-day designs of double-vault UDDTs are based on the Vietnamese double-vault dry toilet, which was developed in the 1960s by local authorities (WINBLAD et al. 2004). Adapted to local needs and climatic conditions (e.g. toilet seats, anal cleansing water diversion, etc.), double-vault UDDTs have been introduced, amongst other countries, in Bangladesh, China, Ecuador, El Salvador, Guatemala, India, Kenya, Mexico, the Philippines, South Africa, Sweden, Vietnam, Yemen, but also cold-climate countries such as Mongolia, Nepal and Romania as cost-effective sanitation component in rural, peri-urban and urban settings.

What is the UDDT?: it is a waterless system that are particularly suitable for conditions where water is scarce or expensive.

An important condition for the success of UDDTs is that sufficient user commitment to the operation and maintenance can be provided. Cleaning of a UDDT seat or squatting pan has to be done carefully with little water, to avoid introduction of water into the vault. The collection chamber has to be checked and emptied in regular intervals. All those tasks require a certain level of responsibility and care from the users. Neglected maintenance can quickly lead to malfunctioning of the process and may severely impair the appearance and hygiene of the toilet.

The UDDT technology was originally promoted in connection with safe reuse of excreta. However, the primary focus of UDDT implementation has gradually shifted from that of

excreta reuse to the broader objective of creating an odourless, dry and versatile toilet that is applicable across wide range of geographic and economic contexts.

UDDT with double dehydration vaults

UDDT with single vault and interchangeable containers

Advantages

Advantages

- Greater reduction of pathogen load after a longer period of dehydration.
- Dry faecal matter is a crumbly, odourless material that is less offensive to handle.
- Long storage durations lead to less frequent emptying.
- No additional transport or treatment costs for situations where on-site disposal or reuse is possible.
- Risk of spreading of untreated faecal material into the environment is greatly reduced.
- Dependency on service providers is low.

Background:

Washing hands at the right time in a right way can save lives

Hand washing:

Material: have a callage of things people do with their hands, times when people should wash their hands

. create discussion, they should lead the discussion.

Health & Hygiene Related Issues

Hygiene messages: Hygiene information, education and awareness programmes will be developed hand in hand with construction projects (water supplies, toilets etc), and will be targeted at all levels:

· personal Hygiene: such as washing hands after going to the toilet or changing the nappies of babies, and before the preparation of food;

· household Hygiene: this includes keeping the home and toilet clean, disposal of refuse and solid waste, cleanliness in areas where food is stored and prepared, and ensuring that food and drinking water is kept covered and uncontaminated; and

· community Hygiene: pests carrying diseases do not respect household boundaries or fences. To achieve improved public health the whole community must be mobilised to work together for better health and a cleaner environment. Community hygiene will include issues related to excreta and

Diarrhoeal diseases are caused by organisms carried in infected human excreta sullage⁸ disposal, solid waste (refuse), hygiene education for food vendors, the keeping of animals and community stormwater drainage.

Raising awareness: Despite the strong links between sanitation and health, there is little public awareness of this, and sanitation is commonly low on peoples' priorities for improved services.

The national sanitation improvement programme will redress this through information dissemination and education to promote awareness of the role of sanitation in health and to stimulate the willingness to pay for toilet facilities and services.

Health personnel will play a strong role in the promotion of health and hygiene, particularly at the local level, where a network of Environmental Health Officers already exists.

Community sanitation will become a strong element of all primary health care programmes and will be linked to new water supply infrastructure. It is essential that all clinic staff set the highest standards for themselves in maintaining hygienic sanitation facilities.

For example, clinics should have appropriate facilities for out-patients' use, of a type that could be affordably copied or modified for household use.

Dialogue: Hygiene promotion requires far more than giving out information and building demonstration toilets. The starting point is to understand current beliefs, perceptions and practices within a particular community. Based on this, relevant messages can be developed so that desirable behaviour change is brought about through dialogue, within the context of people's everyday lives.

Appendix K: UDDT Pamphlet

WHAT IS A URINE DIVERSION DRY TOILET (UDDT)?

- It is a toilet that separates urine, and the faeces collect in a vault. The importance of separating urine and faeces is to (1) reduce odour (2) enable fast drying of faeces which makes handling of faeces more simple and hygienic (3) reduce environmental impacts; and (4) allow for the recovery of urine, which can be reused as fertiliser.
- The excreta inside the UDDT vault are dried with the help of natural evaporation and ventilation. The toilet requires no water for flushing. UDDTs can be successfully used in all climatic conditions and are most advantageous in arid climates where water is scarce and faeces can be effectively dried.

IN WHICH AREAS ARE THEY MOSTLY SUITABLE?

- Applications are typically found where connection to a sewer based sanitation system is not available or areas where water supplies are limited

QUESTION: Are UDDTs only found in South Africa?

ANSWER: No, but in many other countries in Africa and abroad

BENEFITS OF UDDT

- Safe on-site disposal of human waste
- No new pits required to be dug when full
- No need to move top structure when full
- UDDTs are also more resource efficient due to the reuse potential of the product

- UDDTs are waterless systems that are particularly suitable for conditions where water is scarce or expensive. It protects ground water.
- A double-vault UDDT can transform infectious faeces into a safe product ONLY if storage times are respected and the UDDT is operated correctly.
- Odourless and no flies which eliminates transmission of diseases.
- Decomposed contents are safer to handle when removing
- Waste decomposes before being exposed to surrounding soil which minimises water pollution since the faeces are safely contained in a sealed vault.

HOW DO I/WE MAINTAIN THE UDDT?

- Ensure that when sitting on the seat the urine goes in front and faecal matter drops into the back hole. Men use the urinal that is connected to the soak away pit.
- Pour soil / ash every time after defecating.
- Ensure that the lid is closed after defecation.
- Remember to wash your hands with soap!**
- Use damp cloth when cleaning the floor or the seat to ensure that no water enters into the faecal vault.
- Remember to wash your hands with soap!**
- When the first vault is full, move the toilet pedestal and place it over the second vault. By the time the second vault is full the waste in the first vault would be dry and safe to remove. Using tools provided. **Remember to wash your hands with soap!**
- Do not throw any solid waste inside the toilet.
- Do not pour detergents inside the toilet.

NOTE: Children need to be taught and be monitored by an adult on how to use the UDDT because it is important that (a) faeces do not fall into and clog the urine collection area in the front, and that (b) urine does not splash down into the dry area of the toilet.



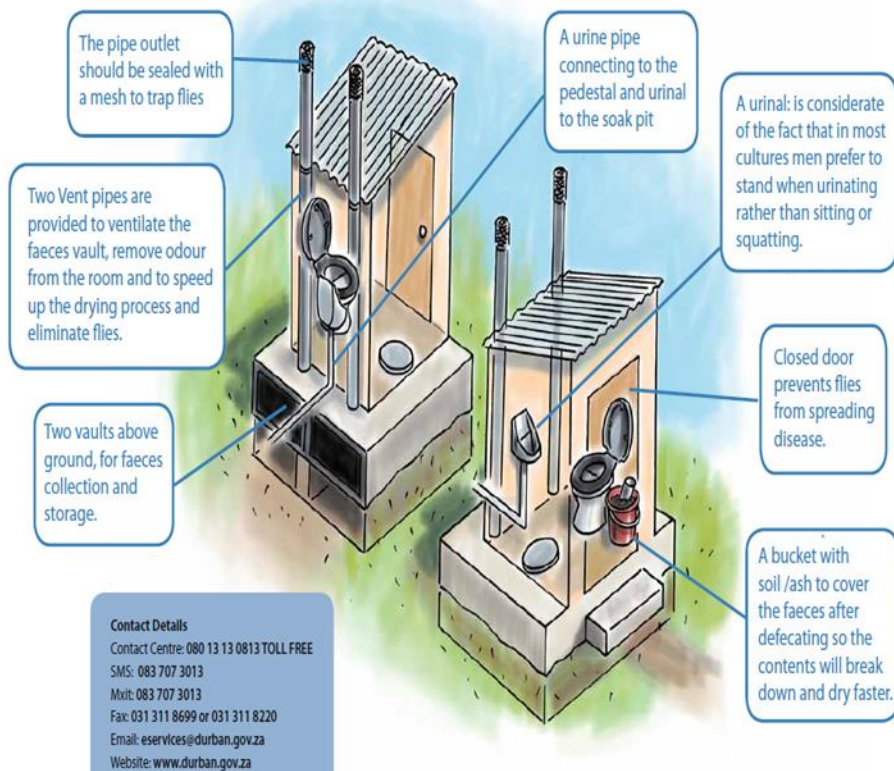
WHAT IS A UDDT TOILET?

WATER AND SANITATION

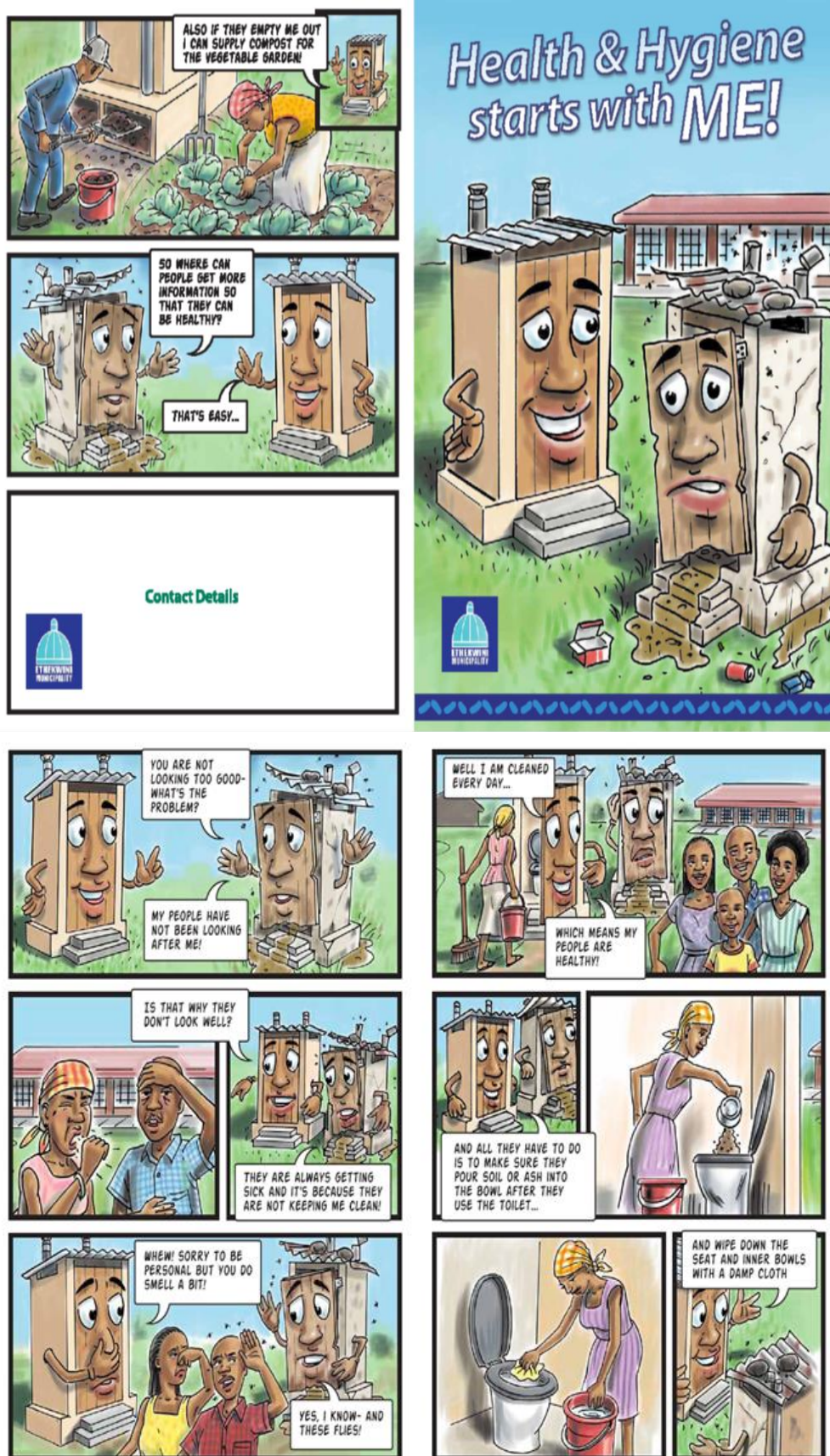


WHAT IS A UDDT TOILET?

UDDT PHYSICAL STRUCTURE AND IMPORTANCE OF EACH ITEM



Appendix L: Comic Book on UDDT



Appendix M: transcript of one of the FGD's

Focus group discussion

Date : 05 May 2013

Area : Maphephetheni

Group type : None maintainers.

Opening and welcome

The Health Promoters (HP) welcomed everyone who was present and acknowledged them for their presence. Introduction was done by every person who was part of the group including the HP's, the participants were given time to read the consent form and Siyaphila further explained the purpose of the meeting.

The group consisted of seven members of whom there were two males, they all seemed interested to hear what they were called for, and all seemed to be in a good mood and were eager to learn and participate. After all was explained, the group went through the discussion.

About the Urine Diversion (UD) toilet

1. The people didn't seem to be sure about the exact date of when they first heard about the UD toilets, they estimated that it was six to seven years ago.

- The toilets were built to prevent faecal matter from spreading in our area since we were using fields to release ourselves, they will also prevent the spread of diseases.
- We were informed about this project through the cars which went around loud hailing and through the meetings that were taking place.
- No, not everything was clear.

2. Lady: it means using to different holes of the toilet.

- The waste will be used as the fertilizer.
- Old man: I think everyone and even the neighbours understand the same thing, but I also think that some don't understand because they are vandalising the toilets by removing the doors for their houses.

4. If you have a large house hold number, you were given two toilets, that is how they did it.

- They moved from one house to the next house, not randomly but in that kind of sequence.

5. Yes (all people agreed)

6. (Old man): I am not satisfied about this toilet in such a way that I am not using it.

- (makoti): the father doesn't want to use the same toilet with females especially with his daughter in law.
- The children have found themselves a playing room since they remove some parts of the toilet and use them for playing.
- I don't like this toilet because of the emptying process.

7. the toilet is built with blocks so that makes its structure strong and that is what we like about it.

- (Young lady): the toilet is good because it also has a small seat for children even though you have to help the child to sit up.
- (Young lady): I don't like the fact that you Have to throw in sand after using the toilet because that's a lot of work. You cannot have sand all the time and grinding the ground to find some is a lot of work. This is even hard for the children.
- (Young girl): I don't like this toilet because you cannot use disinfectants for cleaning it.

- The doors of these toilets are easily ruined, even rainfall destroys these doors, even the seats are braking of making it uncomfortable for you to sit.
- The vaults are just placed, they are not intact.
- (old man): these toilets just make us feel so undeveloped, we thought the municipality was bringing development but instead we feel like we are going back into the olden days, we are not going forward at all. We feel intimidated! That is why I changed mine into something better..... you can even arrest me if you like!

8. (Young lady): children start using the toilet at the age of four, it is easy for them to use it since their small seat is available.

Maintaining the UD toilet.

9. After using the toilet you throw in sand, when full you change the seat and empty the vault. You make sure no liquids get into the toilet. (All people): yes we were given education about all of this information.

10. (man): yes mine did get full and I emptied it just like I was told, yo! That process is so hard! You can actually see the faecal matter and the smell kills you! Really? I don't understand why the municipality has built for us these types of toilets, they are such a burden and no one can stand this!

11. (Man): I don't enjoy the process of emptying the toilet! It is such a disgrace to do it and it smells a lot. It is a man's duty to empty it, no women can do that!

(Old man): that is why I changed mine! It is because of this emptying process which I wouldn't cope with.

(Young lady): the old pit toilets were far better than these toilets! They are not a burden at all! The pit toilets were even better because you are able to use certain chemicals to lower the waste inside and carry on using it for years. Pampers are lying all over the roads now because they can throw them in these toilets.

12. (Young girl): we need mouth muffs for covering ourselves from the terrible smell which comes out from the toilet when emptying it.

14. (Mama): I have seen cars collecting the urine from some houses, but I don't understand what is really happening about the urine collection.

(Rest of the group): we don't know anything about urine being used as a fertilizer, so we cannot comment.

About health and hygiene.

15. Mostly people are not educated since they are not always at home, those who were found home were told that soil or ash should be thrown into the toilet after using it. We were visited only once.

16. (Young Lady): We were happy to receive new toilets not knowing that they are used in such a hard a way.

17. (Old man): mostly it was the females who received education and it was received by only one person. We men are not always at home.

18. The educated person will tell us one by one since we do not arrive on the same time at home, we just gossip about the matter even with our neighbours.

19. (Mama): yes it was easy to hear since it wasn't a lot of information.

20. We were told at the same day of the arrival of educator. Not all the family members were educated. The person who received education didn't seem to member all the information he was told.

21. (Makoti): No one likes these toilets because they are a burden, children are using these toilets for playing dolly house.

22. Yes the information was clear and we are still using that information to operate the toilet.

23. (Man): we do not educate visitors because we assume they also know to use the toilets and thinking that will understand on their own, but for visitors from other places we teach them and the paper on the door also gives instructions.

24. All group members agreed positively.

25. (Young girl): we can't compliment these toilets because we are not satisfied and we are not happy with them.

26. All members: Ay! We have never seen that type of education.

Acceptance.

27. No! No! No! these toilets are intimidating us! (whole group complaining). Our status and dignity is being looked down up!

(Old man): we feel that we are not going forward in life, in terms of development. We thought that the Municipality is bringing us development but instead we get disappointed.

28. (All members): we only have municipal toilets.

(old man): I changed this toilets in a way that suits me and I am happy with it now.

29. (Old man): yes I have made changes to my toilet, it is works as a sceptic tank toilet.

30. (Old man): We feel that we are intimidated and not respected. This toilet does not bring our community to development but instead it sends us back to the olden days.

31. (Man): change these toilets into flushable ones and make use of the Municipal trucks to collect the sewage waste.

Specifics.

1. (Young girl): we know that we have to keep the toilet clean just like we were told.

2. (Young girl): keeping the toilet clean at all times, closing doors, use air fresheners and keep the smell pleasant.

3. (Young Lady): yes we think we are maintaining the toilet since we apply all the information that we were educated about.

(Makoti): the problem is only the kids who like playing in the toilets. (Heartbroken voice)

4. (Young girl): others use it as a wash room.

Others remove the toilet seats.

Others remove doors.

Others use the toilet as a store room, especially those who have two toilets.

5. (All group members changed their faces showing disappointment) the Old man further explained: we really are not pleased about the way these toilets are used and are we are sick and tired of them. The changing of seats creates a lot of job for us and we feel that pit is not deep enough.

All members stated that they do not have all the equipment that were given to them by the time Health Education was conducted, others stated that they are only left with buckets. The young girl asked for mouth muffs saying that she didn't receive them. They all agreed that they do not have posters on the doors anymore.

Finish

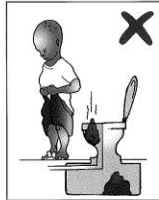
Appendix N: previous EM HHE material on UDDT



KEEP YOUR TOILET WORKING HEALTHILY AND HYGIENICALLY.



1. Faeces are deposited into the back of the toilet bowl, and ladies urinate into the front part.



2. Do not defecate into the front of the toilet.



3. Ash or sand is thrown over faeces after each use. Do not pour water into the pit.



4. Males must not urinate into the back of the toilet, use the separate urinal.



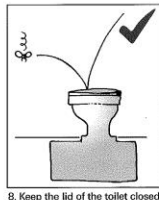
5. Men and boys must use the separate urinal.



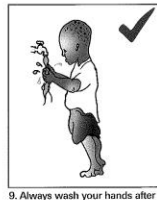
6. Do not throw rubbish into the pit.



7. Clean the urinal with fresh water. Do not use disinfectants.



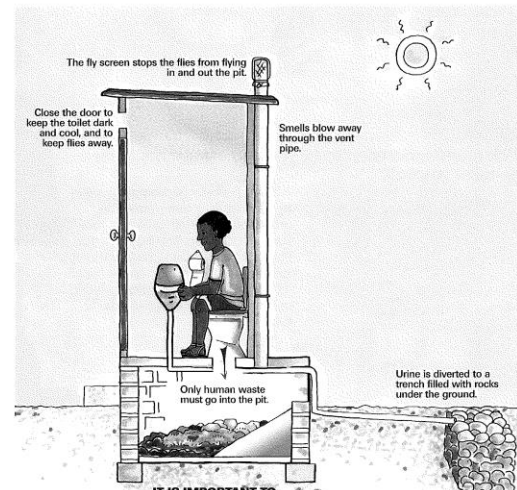
8. Keep the lid of the toilet closed to keep flies out of the pit.



9. Always wash your hands after using the toilet.

HOW A URINE DIVERSION (UD) TOILET WORKS

The UD (Urine Diversion) is a toilet that separates urine and faecal matter. It is important to operate and maintain the toilet properly to prevent smell and flies which could cause the spread of disease.



IT IS IMPORTANT TO:

- Make sure that the fly screen is not broken or blocked. Replace if it is broken.
- Keep the toilet door shut.
- Close the lid of the toilet.

Appendix O: previous EM HHE material on UDDT

HOW TO OPERATE AND MAINTAIN YOUR URINE DIVERSION (UD) TOILET

Most toilets are built with one pit. This pit fills up quickly and must be emptied often. Emptying the pit is expensive.

I cannot reach your toilet.

I cannot pay for the tanker to empty the pit.

With a urine diversion toilet you can always maintain the toilet yourself.

1. Two shallow chambers will have to be built 400 mm below the ground with concrete blocks. The top structure has two holes in the floor. Place the toilet bowl over one hole and use the first chamber until it is full. Keep the second chamber covered until the first chamber is full.
2. The toilet bowl has two parts - one for urine and one for faeces. When women urinate the urine goes into the front part, and flows through a narrow pipe into the soil where it soaks away. Men urinate into a separate urinal that also leads into the soil. Men and women use the toilet bowl for defecating. Faeces drop down the larger hole at the back of the bowl into the pit below.
3. Faeces collects in the chamber below. This dries quickly because there is no urine and it is covered with soil or ash.
4. The contents of the chamber must break down and dry out. Help this process by throwing sand or ash into the pit after each use. No water must get into the pit.
5. When the first chamber is full, use the second chamber. Move the toilet bowl and place it over the second hole and cover the first chamber. While you use the second chamber, the waste in the first chamber dries out. Do not let any water get into the chamber that is drying out.
6. By the time the second chamber is full, the waste in the first chamber will be dry and safe to remove. You can dig out this dried waste in the first pit. When empty move the toilet bowl back to the hole over the first chamber. Use the first chamber while the waste in the second chamber breaks down and dries out.

In this way it will not cost you any money to always keep your toilet hygienic and healthy.