

**EFFECTS OF WATER SHORTAGE ON THE HEALTH OF WOMEN AT MPHENI
VILLAGE, VHEMBE DISTRICT**

BY

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Declaration

I, **Vutlhari Olive Mabolani (11542784)**, hereby declare that the mini-dissertation titled **“Effects of water shortage on the health of women at Mpheni Village, Vhembe District”** submitted to the University of Venda, for the degree of Master of Public Health is my original work and has not been submitted for a degree at this or any other institution, and it is my own work in design and execution. All reference materials contained have been duly acknowledged.

Signature:

Date:

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Dedication

I dedicate this mini-dissertation to my husband, three daughters, mom and mother in-law.

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List of abbreviations/acronyms

DWAF	Department of Water Affairs and Forestry
HBM	Health Belief Model
HIV	Human-Immuno Deficiency Virus
HWSETA	Health and Welfare Sector Education and Training Authority
NWDC	North West Development Corporation
NICD	National Institute for Communicable Diseases
SPSS	Statistical Package for Social Sciences
WDNs	Water Distribution Networks
WHO	World Health Organisation

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Abstract

Water shortage is a situation wherein there is inadequate, unreliable and unaffordable water for a healthy life. Two third of the world's women do not have access to safe and clean water. Water shortage is caused by droughts, poor water supply, contamination of available water and lack of investment in water. Women experienced fear, sexual assault, anxiety, shame, injury, tiredness and suffered from waterborne diseases due to water shortage. Therefore, this study sought to determine the relationship between health effects and water shortage among women at Mpheni Village, Vhembe District. A cross-sectional survey with a descriptive quantitative research design was used. Simple random sampling was used to sample 173 respondents from Vhutuwangadzebu section in Mpheni Village. Face validity and content validity was considered in this study. The test-retest method was used to determine the reliability of the instrument. Questionnaires with closed-ended and open-ended questions were used to collect data. Data analysis was done using SPSS version 25.0. **Chi-square test was used to determine the relationship between water shortage and physical health effects, as well as the psychosocial health effects. The significance level was fixed at $P \leq 0.05$, meaning that any value which was equal to/or less than 0.05 was regarded to have a relationship, while any value above 0.05 was regarded as not having the relationship. The results of this study showed that majority 167(96.5%) women suffered from water shortage. Additionally, the results showed that nearly half 84(48.6%) women felt very tired after collecting water. However, there was no significant relationship ($P=0.943$) between tiredness and water shortage.** There was a very strong significant relationship ($P= 0.000$) between water shortage and psychosocial health in that 125(72.3%) women felt unsafe when collecting water. There should be investment in the development of boreholes. To prevent both physical and psychosocial health effects of water shortage the local government should not only deal with how safe the water is but also on stable water distribution systems. This study should be further investigated especially on vulnerable persons like pregnant women and children.

Keywords: Effects of water shortage, Health of women, Water shortage, Water supply

CHAPTER 1

Overview of the study

1.1. Introduction and background

Water shortage is a situation where there is inadequate, unreliable and unaffordable water for a healthy life (Wutich, Budds and Eichelberger, 2017). It is the basic necessity for all living beings to have safe and clean drinking water (Pahwaringa, Chaminuka and Muranda-Kaseke, 2017). However, water availability may be unreliable, too far from homes, expensive, and may be found in inadequate quantity. When the water quality for domestic use is poor, then even people's health is affected (Bhuyan and Husain, 2013).

World Health Organisation (2017) indicated that 2.1 billion people in the world suffer from water shortage at home. Two hundred and sixty-three million of them spend over 30 minutes per round trip to collect water from an improved source. WHO, (2017) also revealed that people who drink water directly from the source, such as streams and lakes, account for 159 million people. It is also indicated that 844 million people in the world do not have basic drinking water sources. Moreover, two thirds of the world's women live in water-scarce countries and do not have access to safe and clean water (Makwe and Ahmad, 2017).

In India, in different slums of Jorhat, many women experience fear and sexual assault when going to collect water. Some women wait until night comes, so that they can collect water from far away, with the hope that the perpetrators will have gone, only to find that they are putting their lives in danger. They collect water from unprotected sources and the water will be dirty and polluted. Sometimes they are unable to bath regularly in summer because of water shortage (Bhuyan and Husain, 2013).

People who are affected by water shortages are likely to experience shame. Sometimes they are forced to beg for water from their neighbours and when they are denied it, they experience humiliation. By borrowing or begging for water women tend to suffer from anxiety and depression (Wutich and Ragsdale, 2009). Kohrt and Mendenhall (2016) revealed that in the slums of Andhra Pradesh in India, women suffered from psychosocial health effects. They

got scolded by their husbands and felt humiliated before their neighbours because they were unable to keep their homes and families clean as a result of water shortage.

According to Marshall (2011), access to clean water is a problem to 17 million (42%) Kenyans. The major causes of water shortage in Kenya are droughts, poor water supply, contamination of available water and lack of investment in water in the rural areas. Due to the shortage of water, people in Kenya die of thirst and hunger. Some rural African communities living alongside rivers use untreated water for domestic purposes, making them vulnerable to waterborne diseases such as diarrhoea. This happened along Boro-Thamalakane, Boteti river in Botswana because of water shortage. It was found that up to 40 % of the households experienced diarrhoea. The majority of those affected were women (Tubatsi, Bonyongo and Gondwe, 2015).

Having to walk long distances to fetch water exposes women to violence. Women in Malawian refugee camps suffered from violence in relation to access to water. They fought with girls when queuing for water (Sommer, Ferron, Cavin and House, 2015). The same experience was revealed by one study review. It was indicated that Ethiopian women fought while queuing for water. Furthermore, women got beaten for not being able to get water for their families (House and Cavill, 2015).

In South Africa, service policies during apartheid left an unfair distribution of water and sanitation services. Thus, about twelve million people lacked adequate supplies of drinking water (Department of Water, Agriculture and Forestry, 1994). Furthermore, there was no government department that was dedicated to universal supply and management of water resources in South Africa before 1994. The water service infrastructure was run by uncoordinated homeland governments and in the poorer black rural areas they were run inefficiently. In addition, these homelands government structures were entirely dependent on the South African government for funding (Nnadozie, 2011).

However, the new democracy brought universal basic water provision which is coordinated by municipality structures (Roma, Maclead and Buckley, 2013). The new government announced a free basic water and sanitation policy provision, consisting of 25L of drinking water per person per day. The funds for such provision was from the government through the equitable share scheme, infrastructure grants and internal subsidies from water tariffs (Roma, Maclead

and Buckley, 2013). The National Treasury, DWAF, Housing, Health, Education and other departments have held a common vision and strategy for the implementation of water services since 1994. Additionally, the water boards, the private sector and the NGO community were used to leverage the government's capacity (DWAF, 2005).

The national response to address the water service delivery problems had shown promising results because 59 % of the water infrastructure was constructed in 2009 (DWAF, 2010). The people who have been provided with basic water supply through different structures totaled 13, 4 million between 1994 and 2004 (DWAF, 2005). Unfortunately, drought is the major attribute that has depleted water in South Africa. As a result, major cities in South Africa, such as Cape Town and Johannesburg, have been implementing water restrictions. However, the drought has caused dams to have low water levels, causing people to rely on contaminated water (Baudoina, Vogelb, Nortjea and Naika, 2017).

Rankoana (2016) in his study regarding the water shortage in Mokgalakwena, South Africa, indicated that water shortage is caused by climate change. Unfortunately, people in that community also used contaminated water, which led them to suffer from cholera, dysentery and schistosomiasis. Additionally, in a certain village in Vhembe District in Limpopo, old people complained of back pain as a result of fetching water 300m to 500m away from their households (Mudau, Mukhola and Hunter, 2017). Mpheni Village is one of them because the community members there also suffer from water shortage. Women in particular suffer the most because they are responsible for the day to day supply of water to their families and their chores revolve around water.

1.2. Problem statement

Statistics South Africa (2011), revealed that only 12.3 % of households at Mpheni had piped water in their dwellings. Additionally, water shortage is an ongoing problem and in 2016 the Mpheni Village water supply system was not operational yet. That has led women at Vhutuwangadzebu section to suffer. Most of these women were unemployed (Mukwevho, 2016). Unfortunately, the water tanker normally takes 3 weeks before supplying them with water. Women at Vhutuwangadzebu section therefore used the little money they had to buy water from their neighbours who have boreholes.

Vhutuwangadzebu section in Mpheni Village has rugged paths. However, women travelled long distances of about 3 km to the river to fetch water. The water was used for different household purposes, including drinking and cooking (Mukwevho, 2016). The current researcher observed that the river from which these women collect water was dirty, with garbage and the water had a bad odour. It was also observed that there was no fence alongside the river and animals like cattle often defecate in it, leaving the water contaminated.

1.3. Rationale for the study

The researcher sought to carry out a study on the effects of water shortage on the health of women at Mpheni Village. That is because waterborne diseases continue to kill many people worldwide every day because of water shortage. For example, 1.5 million people globally die from diarrhoeal diseases annually (Degebasa, Weldemichael and Marama, 2018). Therefore, women at Mpheni Village might also be at risk of physical and psychosocial health effects of water shortage that may lead to permanent disability or death.

The researcher chose this study because to the best of the researcher's knowledge there had not been any study regarding the effects of water shortage on the health of women at Mpheni Village previously. Most studies had focused on the time and distance travelled to access water, types of water sources used and the women's involvement in water management, rather than the overall health effects women experience due to water shortages. However, a research by Mudau et al, (2017) focused on the physical health effects of the water shortage. Based on that study, the researcher recommended a study of the psychosocial health effects of the water shortage. This therefore indicates that there is a need to carry out this type of study at Mpheni Village.

1.4. Aim of the study

The aim of this research was to determine the relationship between water shortage and the health of women at Mpheni Village.

1.5. Objectives of the study

- To assess the factors contributing to water shortage at Mpheni Village.
- To determine the physical health effects of water shortage among women at Mpheni Village.
- To determine the psychosocial health effects of water shortage among women at Mpheni Village.

1.6. Significance of the Study

The Department of Health in Vhembe District might use the findings of this research to plan its health promotion and health education programmes. That would help prevent waterborne diseases. Through the findings of this research, the Vhembe District Municipality might take it as a useful tool for making informed decisions concerning water supply at Mpheni Village. The recommendations of this research might also help to improve women and their families' involvement in the management of the water systems at Mpheni Village. By achieving the objectives of this research, the University of Venda might gain some knowledge on the effects of water shortage on the health of women. The research recommendations might also influence the need to carry out further research at Mpheni Village.

1.7. Hypothesis

- Effects of water shortage would not affect the physical and psychosocial health of women

1.8. Definition of key terms

1.8.1. **Effects** are the changes in health as attributable to exposure to certain biological, physical, chemical factors (Kohrt and Mendenhall, 2016). In this research it is the changes in the physical and psychosocial health of women due to water shortage.

1.8.2. **Health** is defined by WHO, (1948) as a state of complete physical, mental and social wellbeing of individuals and not the mere absence of diseases or infirmities adopted (Vasuthevan and Mthembu 2016). In this research it is the overall wellbeing of women, particularly their physical, mental and social wellbeing.

1.8.3. **Water shortage** is a situation where there is inadequate, unreliable and unaffordable water for a healthy life (Wutich et al, 2017). In this research it is the lack of enough, affordable clean water within a 200 m radius from the house.

1.8.4. **Woman** refers to the adult female person Concise Oxford English Dictionary (2006). In this study it is a mature female individual from the age of 18 years.

1.9. Conclusion

This chapter **provided** the introduction and background on water shortage among women. It also **included** the problem statement, rationale, significance of the study and definition of key terms. The following chapter will describe the literature review.

CHAPTER 2

Literature review

2.1. Introduction

The previous chapter discussed the introduction and background on water shortage among women, problem statement, rationale, significance of the study and definition of key terms. This chapter will cover relevant literature on factors contributing to water shortage, physical and psychosocial health effects of water shortage. It will be international, national and local literature. Sources of information will come from government documents, internet, journals, previous research and books.

2.2. Factors contributing to the water shortage

The factors that contribute to water shortage includes overpopulation, pollution, droughts, financial constraints, political interference and lack of maintenance. These factors affect affordability, adequacy, reliability and safety of the water.

2.2.1. Overpopulation

The increase in population contributes towards water shortage, particularly in developing countries, where the economic power for preparing water supply systems is not enough for all people. For example, in the city of Gweru in Zimbabwe, the authority stopped supplying water to the people because they had financial constraints (Tsitsi, 2016). People migrated to the industrial areas in search of better jobs and business, and that led to a shortage of water. A study was conducted to analyse the adverse impact of population growth on water resources in Libya. It found that there was a high demand of water in the country because of rapid population growth that led to water shortage, as water sources were strained (Abughlelesha and Lateh, 2013).

2.2.2. Pollution

Water can be polluted by development projects and agricultural activities. It was found that saline rates have been radically increased in the most populated areas in South Africa because of sea water intrusion (Abughlelesha and Lateh, 2013). During the construction of houses for settlement, sediments may be transported through the air and runoff water during rainy seasons. These get into the rivers and may contaminate the water. The same applies to the pollution from agricultural pollutants like pesticides and herbicides. These will be transported to the water bodies and eventually cause water pollution (Muller, Schreiner, Smith, Van Koppen, Sally, Aliber, Cousins, Tapela, Van der Merwe-Botha, Karar and Pietersen, 2009).

Noosorn and Niamkamnerd (2009), conducted a study on public participation to minimize waterborne diseases in Yom Riverside communities. It was found that pollution is the main problem that led to waterborne diseases. Many activities like washing contaminated clothes in the river were contributory factors to the shortage of clean water. People from Yom community were forced to rely on this river water during the flood season.

Nabi, Ali, Khan and Kumar (2019), revealed that in Pakistan nearly 80% of the population depend on polluted water because there was no clean water in the country. The water is contaminated by sewage, fertilisers, pesticides and industrial effluents. That degraded the water quality which also contributed to water shortage. It was also revealed that only 20% of Pakistan population had access to clean water.

2.2.3. Drought

Drought happens when there is little rainfall than is normal and when there is an increase in surface evaporation and that caused water shortage (Acutt and Hattingh, 2011). Kenya, for instance, has over the past decades suffered from severe drought. The prolonged drought was attributable to global warming. Consequently, millions of Kenyans starved because their livestock died and the soil could not sustain their crops, so they were left without food (Marshall, 2011). It was estimated that in South Africa, specifically, global warming would cause significant losses in the little runoff that does occur. The water shortage in South Africa is exacerbated by global warming, which later affects vegetation growth, and that worsens the effects of drought because there will be less infiltration and increased runoff (Wassung, 2010).

2.2.4. Financial constraints

In Kenya there has been an increased need for funding, management and development of water resources. The actions taken have not been effective because organizations in charge of managing water resources have failed. The National Water Conservation and Pipeline Corporation that was planned to manage piped water systems only managed to serve 3.8 % of the people. This was not enough for everyone due to budget constraints, which left others suffering from water shortage (Marshall, 2011).

A study by Mirzaei, Knierim, Nahavand and Mahmoudi (2019), revealed that in Mazandaran in Northern Iran there was unstable and insignificant budget for the rehabilitation of reservoirs leading to water shortage. Furthermore, Mnguni (2018), revealed that shortage of funds for developing, renewing and upgrading or replacement of infrastructure was the old problem in Ekuruleni and Tshwane municipalities in South Africa. It was revealed that 35 % of the waste water treatment plants required capital investment for upgrades. This also led to water shortage in these municipalities.

2.2.5. Political interference

Financial constraints may not be an issue in terms of water provision; however, political interference may be the cause. In North America, the Great Lakes are a large source of fresh water but they were not available to everyone. The permits to use water from the Lake were restricted to applicants within the Great Lakes Basin. People from Waukesha and Wisconsin gained permission in 2016 in order to use the water from the Lake due to political interference (Stuchneberg and Contento, 2018).

Anderson (2016), also revealed that Ethiopia demanded water from the Nile River for hydroelectric power while Egypt relied on the same River for years. This has caused political dispute. Turkey also relied on the River for construction of dams that has caused the water flowing into Syria to be cut by 40% and into Iraq by 80%. That has led other people in these cities suffering from water shortage.

Due to political interference the funds allocated for water supply may end up being used improperly. In one of the villages studied in Vhembe District, getting water services for other side of the community was a political problem. This was because the municipality could not service the whole community because the budget could not cover the whole area (Mothetha, Nkuna and Mema, 2013).

2.2.6. Lack of maintenance

Water distribution networks (WDNs) are considered as some of the essential urban infrastructure. The water distribution networks supply water to the communities with sufficient pressure, quantity and quality. These networks may sometimes fail due to unexpected events, such as pipe bursts, pump failure and equipment failures. When that happens, there would be a water shortage in the community (Kapelan, Savić and Mahmoud, 2016). Failure of water distribution systems is a problem because people may not be able to get water, even if clean water is there.

Mothetha et al. (2013) revealed that the water supply network is also affected by lack of municipal operators who are responsible for the maintenance of infrastructure, and that means the boreholes will take time to be fixed. Furthermore, it was found that one of the boreholes in Vhembe had not been functional for more than two years. Finally, it was found that tap heads were damaged or stolen.

2.3. Physical health effects of water shortage

Both low and high socioeconomic groups of people suffer from the waterborne diseases but the low socioeconomic group is more vulnerable and becomes susceptible to water related diseases because of the shortage of water (Collins, Robertson and Govinder, 2015). The physical health effects are concerned with the diseases, conditions and disabilities that can prevent the functioning of the physical body. In this study they include different types of waterborne diseases, injuries, pain, dehydration and fatigue.

2.3.1. Diarrhoea

Diarrhoea is a disease causing a passage of a greater number of loose stools or liquid stools lasting for more than it would normally do. Diarrhoea can be caused by drinking water contaminated with raw sewage, silt, oil or chemical wastes. A Canadian community as studied by Sarkar, Hanrahan and Hudson (2015) suffered from the effects of water shortages. People got domestic water from natural sources such as streams, brooks, and ponds. These sources were contaminated with animal faeces and the water was not disinfected. That led them to suffer from diarrhoea among the community members.

Additionally, women from Gaibandha in Bangladesh experienced climate change effects in the form of floods. During floods they and their families got displaced, and because of that, they were affected by water shortage. During that season the water sources were destroyed, which led them to work long hours searching for water, so that their children could at least have clean water. They could manage to get one or two bottles of water for their children, but they also had unclean water, and that led to diarrhoea. Thirty-four percent of the women lacked clean water for drinking (Alston, 2015).

2.3.2. Cholera

Cholera is a communicable disease in which people present with sudden onset of abdominal cramps along with severe diarrhoea of rice water stools and vomiting and can lead to dehydration (Vasuthevan and Mthembu, 2016). It can also be transmitted through water contaminated with faeces. People in poor communities use water from the rivers where animals drink and excrete into and that is mainly because of water shortages.

Mudau et al. (2017) conducted a study in 11 rural villages of the Vhembe District municipality near the border with South Africa and Zimbabwe. The study was aimed at making a follow-up of a cholera outbreak in 2008 and 2009. These communities also experienced poor access to potable water because the improved sources of water were distance away from their households; so, they continued to use untreated water, rather than the water supplied by the municipality. They got their water from unprotected dug well, spring, river and tanker truck and that led to a cholera outbreak.

Moreover, a descriptive retrospective study was conducted regarding six thousand two hundred and seventy-eight cholera cases recorded in Mpumalanga in South Africa. The cases resulted into 30 deaths between December 2008 and March 2009. The study results showed

that although 3874 (60%) people had access to water, the water table which is used of the recharge of the boreholes they relied on for domestic use, was contaminated by surface run-off following a heavy rainfall (Sigudu, Tint, and Archer, 2015).

2.3.3. Typhoid fever

Ramutshila, Mabotja, Makungo, Thomas, Smith, William, Khosa, Ranoto, Mosoma, Phokane, Ntshoe, Claver, Essel and McCarthy (2018) defined Typhoid fever as a disease caused by *Salmonella enterica* subspecies *enterica* serotype. It usually appears after an average incubation period of 7-14 days. Transmission may be from person to person through ingestion of food or water that is contaminated with faeces. Outbreaks of typhoid fever are often attributable to contamination of a drinking water. Irrigation of crops with sewage-contaminated water or fertilizers may also be the pathway of contamination. The person infected may suffer from symptoms such as headache, fever, constipation, abdominal pain or cramps which may lead to death if left untreated (National Institute for communicable diseases, 2016).

In a study by Manyawkal (2015), it was revealed that typhoid (24.6 %) was the most prevalent disease which was attributable to drinking unsafe water. Households (49.8%) depended on river water at Endegagn Woreda in Ethiopia. In South Africa, however the data released by the Department of Health showed that the incidence of typhoid fever was in the order of 1.04 cases per 100,000 population per year. That is based on the number of typhoid cases notified to the health authority. Typhoid fever became known as a notifiable disease in South Africa as from 1919 (Khan, 2004). In Delmas in Mpumalanga Province, typhoid fever outbreaks were experienced repeatedly, with over 1000 cases during 1993, and over 400 suspected cases and three deaths in 2005 (National Institute for communicable diseases, 2017).

2.3.4. Schistosomiasis

Schistosomiasis is also known as Bilharzias. It is caused by the bacteria *Schistosoma haematobium*. The transmission route for Schistosomiasis is via cercariae from the *Bulinus* snail. The parasite enters the human as they enter into the water by penetrating through the skin (Vasuthevan and Mthembu, 2016). Most people, especially women and children, get infected because they tend to wash their clothes in the unsafe river water and also collect water from the rivers as they get into the river they get infected unknowingly. That happens because of the shortage of water in their homes.

Norseth, Ndhlovu, Kleppa, Randrianasolo and Jourdan (2014), revealed that about 207 million people in the world are infected with Schistosomiasis. It is indicated that in 76 endemic countries about 800 million people are at risk of being infected by Schistosomiasis. Four million people in South Africa are estimated to be infected and that covers a quarter of the country. Sixteen million women in endemic areas are affected by urogenital Schistosomiasis. Women infected would present with abnormal vaginal discharge, contact bleeding, genital tumours, ectopic pregnancies and sandy patches. Most women get infected as from their childhood. However, some people have clean water but tend to go to the river to wash their clothes and bath there because clean water is not enough to do all household activities (Norseth et al, 2014).

2.3.5. Trachoma

Trachoma is a preventable blindness occurring because of shortage of water along with poor environmental sanitation and poor socioeconomic status. Although it is preventable, it can be transferred from one person to another by flies (Ramesh, Kovats, Haslam, Schmidt and Gilbert, 2013). Gelaw (2015) indicated that about 40.6 million people worldwide suffer from active trachoma. In Africa 68.5 % people are affected by active trachoma, especially in Ethiopia and Sudan, particularly among women and refugees. Trachoma which affects the eyes, was prevalent among women and was accountable to 72, 8 % in South Western Ethiopia.

Blinding trachoma was identified to be significantly common among females (20.11%) especially among the refugees. The socio-economic state of the refugees and the lack of water worsens the disease because people might not have jobs or enough money to buy water. The other factor is that people walk long distances where there is dust; so without water their eyes get infected. Women would allow other members of the family to bath first and they would be the last and only to find that there is insufficient water left for them (Gelaw, 2015).

2.3.6. Pains and injuries

An exploratory study was conducted in order to determine the water shortages of a remote indigenous community in Black Tickle-Domino, Canada. The study also looked at the health effects. It was found that the residents collected water from a portable drinking water unit which was located nearly 2 km away from their houses. It was also indicated that community

members suffered from chronic back and shoulder injuries. That was mainly because they had to carry heavy water buckets every day (Sarkar et al, 2015).

Additionally, Rosinger (2017) indicated that women from Tsimane in the lowland of Bolivia were more likely to report injury while fetching water than men because of floods. Twelve of the eighteen women reported that riverbanks were muddy after heavy rains. That led to injuries and would show scars of broken bones that occurred during bad falls. Therefore, these women relied on river water as their source because of the shortage of water. These findings, therefore, show how serious the implications of water shortage are to the health of the people, with special reference to accessibility of water.

Pahwaringira et al. (2017) also revealed that women from Mabvuku in Harare experienced chest pain. They had to walk long distances three to four times a day to fetch water. It was also found that other women would be carrying babies on their backs while carrying 20-25 litres plastic containers of water. In developing countries, especially in the rural areas, transportation infrastructure is poor. The other reason is, because fetching water sometimes includes walking on poorly planned and messy roadways where there are vehicles and cyclists injuries, death my result.

Moreover, in a pilot study on domestic water and its implications for health, Geere, Hunter and Jagals (2010) indicated that in Limpopo Province in South Africa 69% of the women suffered from spinal pain, while 38 % suffered from back pain because of carrying water for long distances.

2.3.7. Dehydration

Water is the most important element and people cannot live without it for more than 10 days. Water shortages at home may therefore cause inadequate intake of water, which may result in dehydration. Dehydration leads to shortness of breath and increases the pulse rate, causing blood vessels to tighten in order for the blood pressure to be maintained. People may also suffer from nausea, fatigue, headache, dry mouth and reduced mental acuity. Some people may also faint or experience heart failure due to dehydration (Sircus, 2014).

Unfortunately, replacing the water loss from the body with a fresh intake of water may be hindered when there is a shortage of water. Alston (2015) revealed that 27% of the women in

Gaibandha in Bangladesh suffered from dehydration. That happened during floods because although water was abundant it was unclean; so, they could not drink it.

2.3.8. Malnutrition

The shortage of water may also cause a reduction in agricultural production. As a result, there will also be reduction in nutrient consumption. People may suffer from malnutrition because of this reduction (Rocha and Soares, 2012). However, malnutrition may also be worsened by lack of money to buy adequate food. Acutt and Hattingh (2011), indicated that food production may be affected by people's ignorance to utilize and preserve water sources, so that they are not polluted. Many pregnant women (46.4 %) had to change their diet during their 8th month in order to buy water, due to shortage of water in Kenya. They also had to reduce the frequency of taking their food and change the diversity of food because most of their time was spent collecting water or buying water with the money meant for food (Collins, Miller, Mbullo, Buateng, Wekesa, Onono, and Young, 2017).

2.3.9. Fatigue

Lack of water nearby may cause people to walk long distances to fetch it. That does not only put their lives in danger of being injured, but they may get too tired in that sometimes they have to walk on uneven hilly roads. This is a case that was revealed by Pomells (2015) who stated that pregnant women in East Africa suffered from fatigue. This is because they had to travel extreme distances in order to collect water because they had no one to help as well as because of the cultural perceptions that women play the role of fetching water. Asaba, Fagan, Kabonesa, and Mugumya (2013) also indicated that women from rural Uganda who collected water from afar suffered from fatigue.

2.4. Psychosocial health effects of water shortage

This section discusses the influence of social factors on women's minds or behaviour in relation to the water shortage. These include worry, rape, fear, stress, assault, shame and humiliation.

2.4.1. Worry

Kohrt and Mendenhall (2016) revealed that people who suffer from water shortage do not only suffer from health problems such as dehydration, hunger and waterborne diseases but also suffer from mental health. It was also indicated that women are the most vulnerable to mental health. This is because they are the ones who have to solve the daily water problems in their households. They worry about water all the time, particularly where they are going to get water for their families to survive. Collins et al. (2017) indicated that 65.5 % of the women in Kenya were anxious that they would not have enough safe water to drink.

2.4.2. Rape

Isolated and vulnerable women who walked long distances to fetch water were identified in East Africa. Most of these women got raped. Men found an opportunity to rape them, especially in the early hours of the morning or late in the evening, when people did not see them. It was also revealed that the more isolated the path that women used to go and fetch water, the riskier it was for them to get raped. It was also indicated that men would get evil thoughts to even wait for women or study the times at which the women pass to fetch water, in order to rape them. Some of the women end up being infected by HIV (Pommells, 2015).

Alam (2015) also revealed that when women in South Sudan were walking alone for long distances to fetch water, they were exposed to physical dangers such as rape and kidnapping. Moreover, Fonjong and Abongwa Ngekwi (2014) revealed that 55.6 % of women in Cameroon indicated that water shortage had exposed them to rape and sexual harassment. This is because they had to travel long distances to the water source alone in bushy areas, in order to get water. Similarly, Asaba et al. (2013) revealed that when collecting water at unimproved water sources, women from Makondo Parish in Uganda were exposed to rape.

2.4.3. Fear

In places where there is terrorism, for example, Nigeria, women suffer from fear of being kidnapped and abducted as they go to fetch water away from their homes. Because of these fears, they end up resorting to using of unsafe water, especially in Borno, Yobe and Adamawa (Makwe and Hadiza, 2017). It was also revealed that pregnant women feared that they would undergo early labour or miscarriage as a result of carrying water for long distances (Collins et

al, 2017). Moreover, women also suffered from the fear of being attacked by snakes and foxes as they go to fetch water from unimproved sources (Asaba et al, 2013).

2.4.4. Stress

Increased stress was seen as attributable to carrying water everyday over long distances among the women in Gwagwalada Area Council in Nigeria due to water shortage in their households (Makwe and Hadiza, 2017). Furthermore, Fonjong and Abongwa Ngekwi (2014) indicated that nursing mothers in Buea Municipality in Cameroon had financial stress because more money was spent buying or paying people to fetch water for them.

People from indigenous Canada suffered from stress as they thought about the money they had to have in order to buy water. They had to buy a bottle of water at \$ 1.25, which is equivalent to R16.28. That resulted in others relying on fussy drinks to quench their thirst, as it was cheaper. Furthermore, because the location where they had to buy water was too far they had to also have money for a snowmobile gas, which was sometimes scarce. Health promotion and education interventions were made but failed because water was expensive (Sarkar et al, 2015).

Asaba et al. (2013) revealed that the collection of water in communal points at Makondo Parish in South Central Uganda is difficult because there were long queues, which led to stress. Widows in Onjiko location in Western Kenya in Nyanza province suffered from financial stress brought about by water shortage. The money that was supposed to cover other things in their households was channeled to water (Gabrielsson and Ramasar, 2013). Stress due to water shortage may happen because in some households only one person may have an income to cover all expenditures. Furthermore, some have no steady income or no income at all, except for social grants. This makes people to always worry about where they are going to get the money to buy water.

2.4.5. Assault

It was revealed that 40.3 % of pregnant women from Kenya suffered from verbal abuse as they interacted with other people at unimproved water sources (Collins et al, 2017). Furthermore, the cross-sectional study survey done in South-Central Uganda indicated that women experienced assault. They would also fight over who came first, who was going to collect water first and some people would skip queues and start fights (Asaba et al, 2013). In

another study, Setu, Hossain, Saha and Rahman (2014) found that women in Bangladesh experienced physical violence for not fetching drinking water on time or because of the amount of time it took for them to fetch water, so they could not prepare food on time.

The same experiences were recorded in Ethiopia, at South Gondor by Stevenson, Leslie, Maes, Ambelu, Tesfaye, Rheingans and Craig (2016). Women would sometimes not get water at all from the sources. When it was time for eating and the husbands found that there was no food prepared, the women would be insulted and assaulted. That would surely make these women's life miserable. In some instances the husbands would feel angry, agitated and argue with the women and end up hitting them (Pommells, 2015).

2.4.6. Shame and humiliation

Unhygienic practices at homes may be as a result of water shortages. People may end up not washing their bodies or hands after coming from the toilets. Furthermore, they may not be able to clean their houses and toilets because of the shortage of water. Collins et al. (2017), indicated that 55.7% of the pregnant women in their 8th months in Kenya were not able to wash their hands after defecating, changing diapers or even after touching dirty things because of the shortage of water. Furthermore, women at South Gondor in Ethiopia also experienced shame in that they would appear dirty before others and because they could not wash their clothes, as revealed by Stevenson et al. (2012). Machete (2011) also revealed that due to the water shortage, people in Ga-Kgapane Township in Limpopo sometimes lacked water for bathing and cleaning. That brought humiliation and shame.

2.5. Conclusion

In this chapter, literature indicates that in the developing countries there is a problem of water shortage because of overpopulation. Most people flock to the cities to find work and that result in high demand for water. Other factors of water shortage discussed include pollution, drought, financial constraints, political interference and lack of maintenance. Literature also revealed that women also suffer from waterborne diseases because they drink contaminated water and they are faced with injuries and pain because of the difficulty in accessing clean water. Moreover, literature shows that women around the world suffer from worry, rape, fear, stress, assault, shame and humiliation due to water shortage. In the following chapter, the research methodology will be discussed.

CHAPTER 3

Research methodology

3.1. Introduction

The previous chapter focused on literature review regarding factors contributing to water shortage, physical and psychosocial health effects of water shortage among women internationally, nationally and locally. This chapter discussed the theoretical framework, study design, study setting, study population, sampling, inclusion and exclusion criteria, instrumentation, pre-testing of the research instrument, validity and reliability of instrument, data collection, data management and analysis, ethical considerations, plan for dissemination and implementation of results.

3.2. Theoretical framework

This study was guided by Health Belief Model (HBM). Please refer to Figure 3.1. This theory was used to describe and analyze the link between the problem of water shortage and the effects on health in this study. The Health Belief Model is a conceptual formulation for understanding why individuals do not get involved in a wide variety of health-related actions. It asserts that behavior depends mainly upon the value placed by an individual on a particular goal and the approximation of the likelihood that a given action will achieve such a goal (Mudundulu, 2011).

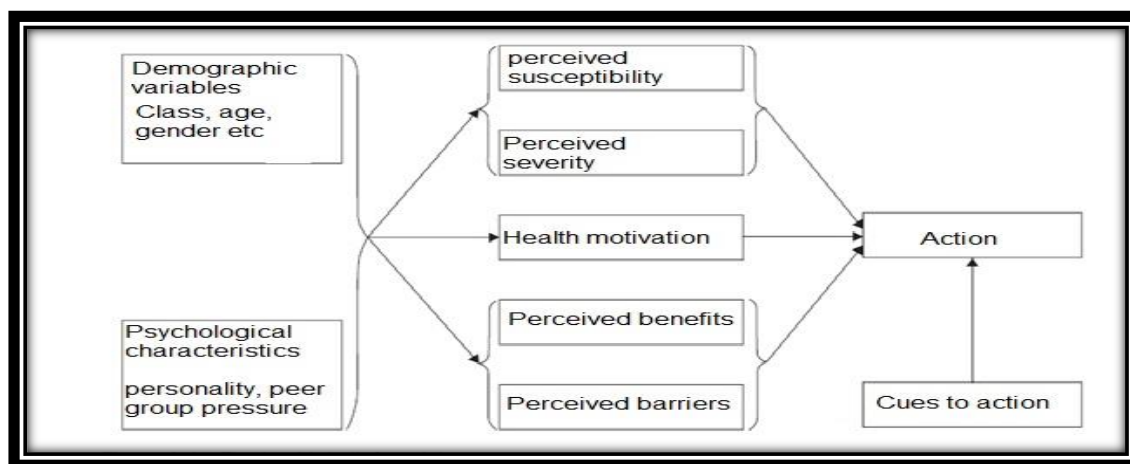


Figure 3.1. The health belief model (Conner and Norman, 2015).

During the 1950s social psychologists in the United States developed the Health Belief Model. The development was made to explain the widespread failure of people to take part in programs, to ensure prevention and detection of diseases (Skinner, Tiro and Champion, 2015). There are four concepts of HBM which were developed. They include perceived susceptibility, perceived severity, perceived benefits and perceived barriers. The health belief model outlines demographic and psychological factors that might influence one's perception of susceptibility. For example, age, gender, race, socioeconomic status, education and knowledge, personality and peer pressure (Kuykandall, 2018). Demographic factors might influence how respondents may think about their vulnerability to waterborne diseases during water shortage.

Perceived susceptibility refers to how much individuals believe they are at risk of a condition (Kuykandall, 2018). If the respondents did not believe that they were at risk of waterborne disease, then they might have not purified the water before using it. Perceived severity refers to a person's feelings on the seriousness of contracting an illness or disease. For example, medical effects like death and disability (LaMorte, 2016). If the respondent felt that waterborne disease was not serious and could be easily remedied, then she would be less likely drink clean water.

LaMorte (2016) revealed that perceived benefits are a person's perceptions of the usefulness of different actions available to reduce the threat of illness, disease or even to cure the illness or disease. For example, If the respondent believed that a particular action would reduce susceptibility to a health problem or decrease its seriousness, then she would be likely to engage in that behaviour regardless of objective facts regarding the effectiveness of the action.

Perceived barrier refers to the perception of cost associated with adhering to a recommended health behaviour if it is likely to be beneficial in reducing or eliminating the perceived threat (Cockerham, 2017). There are varied feelings of barriers which people experience, which may lead to a cost/benefit analysis of the actions; for example, expense, danger, pain, time, or inconvenience. For example, lack of access to water services may act as a barrier to receiving clean water.

Cue to action is the stimulus needed to prompt the decision-making process, to accept a recommended health action. These cues can be internal, for example, when a person starts experiencing chest pains, wheezing or external advice from others; as well as the illness of

family members, newspaper article. Finally, self-efficacy implies the level of an individual's confidence in his or her ability to behave successfully when doing something (LaMorte, 2016).

The HBM has been used to study different health behaviours among different populations. The broad range of these behaviours are preventive health behaviours, which include health promoting activities such as diet or exercise as well as health-risk behaviours such as smoking, vaccination and contraceptives. Another form of health behaviour is the sick role behaviours which is associated with the adherence to recommended medical treatments. Finally, there is clinic use, which involves physician visits for a variety of reasons (Conner and Norman, 2015).

Health education and promotion program would increase perceived susceptibility, perceived severity, perceived benefits of actions taken to prevent waterborne diseases. A person who has seen someone suffer from waterborne disease as a result of water shortage is likely to be led to preventive behaviour, such as boiling or chlorinating the available water before use.

3.3. Study design

Study design refers to the procedure and plans of a research that span the decisions from the broad assumptions to the details of the method of data collection and analysis (Cresswell, 2014). A quantitative research design was adopted for this study. The study was descriptive in nature, using a cross-sectional survey. The advantage of this approach is that it reduces redundancy of data and it measures variables more precisely. However, its disadvantage is that it requires a large sample size, which is much more difficult to obtain (Plonsky, 2015).

3.4. Study Setting

The study was carried out at Mpheni Village, which is located in Limpopo Province in the Vhembe District. Refer to Figure 3.2. for the locality map of Mpheni Village. Mpheni Village consists of Vhutuwangadzebu, Sections B and C. The research only covered Vhutuwangadzebu Section because of lack of resources and limited time to complete the research.

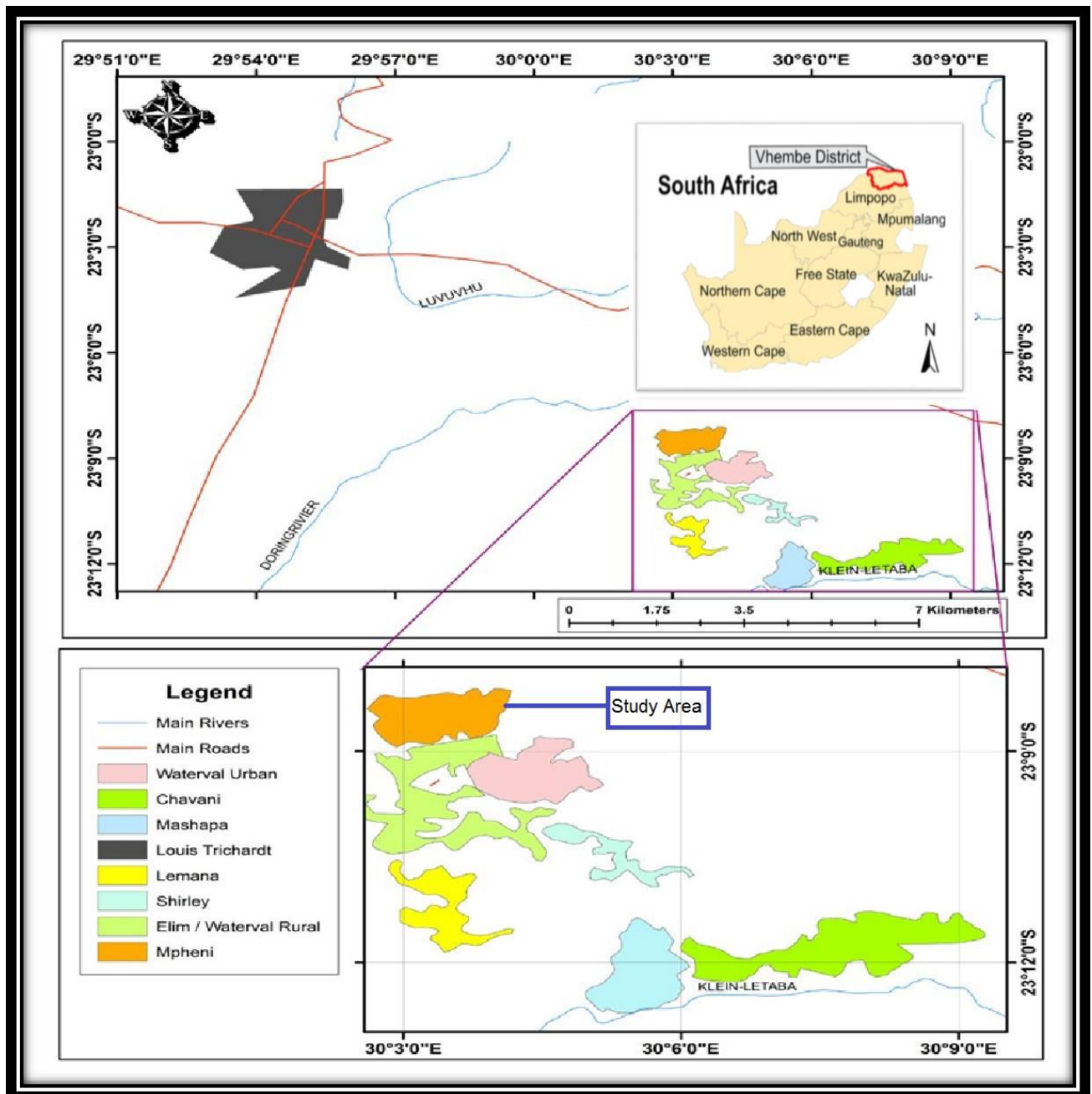


Figure 3.2. Locality map of Mpheni Village in Limpopo (Mhlongo, 2018).

Mpheni Village comprised of five municipal boreholes, from which standpipes were connected. They were built in 1995/96 at RDP level of service. Four of the boreholes used electrical pumps, while the other used diesel. However, the four boreholes have stopped working and the village is supplied with water from the diesel pumped borehole. Approximately 1000 households had yard connections, whereas other parts of the village were not covered by the project. That caused people to travel a distance of about one kilometre to the nearest standpipe to collect water (De la Harpe, 2000).

One communal pipe is shared by nearly 900 people and they only get water once in two weeks. Statistics South Africa, 2011 revealed that 30, 7% of the people relied on borehole water that they have drilled in their yards. It was also revealed that 4, 8 % of the people relied on river water.

3.5. Study population

Population is defined by Etikan, Musa and AlkaAlkassim (2016) as the total quantity of the things or cases which are the subject of the research. Mpheni Village had a total population of 7087 women and Vhutuwangadzebu had about 267 women (Statistics South Africa, 2011). Refer to Table 3.1. The target population for this study covered women who were 18 years of age and above, with different marital and socioeconomic statuses. This is to show how the effects of water shortage on health vary among women of different ages, marital statuses and socioeconomic statuses.

Table 3.1. Mpheni Village population (Statistics South Africa, 2011)

Section	Population (women)
Vhutuwangadzebu	267
Block B	2846
Block C	3974
Total women at Mpheni	7087

3.6. Sampling

Sampling is defined by Mugo (2002) as a set of respondents selected from a large population for the purpose of a survey.

3.6.1. Sample size

Rossi, Wright and Anderson (2013) defined a sample as a subset of the population. One hundred and seventy-three women from Vhutuwangadzebu at Mpheni Village was selected.

Slovin's formula was used to find the sample size, which is the number of participants in a sample, and makes it possible to quickly determine a reasonable sample within a population which is not biased. Slovin's formula is presented as $n = N / (1 + Ne^2)$ (Hitan, 2013). The sample size (n) was drawn from the total population (N), which was 267. The error tolerance (e) was set at a constant value of 0.05. Based on those values, the researcher found that the sample size was 157. Furthermore, 10 % was added to cover the number of those who would not have completed the questionnaire, so that the target is not compromised. Then the final sample size was 173.

$$n = N / (1 + (Ne^2))$$

$$n = 267 / [1 + (267 * 0,05)^2]$$

$$n = 267 / 1 + 0.66$$

$$n = 267 / 1.7$$

$$n = 157 + 10\%$$

$$n = 173$$

3.6.2. Sampling participants

Samples were selected based on simple random sampling. Simple random sampling is a type of sampling in which each and every element of the population has an equal chance of being selected in the sample (Acharya, Prakash, Saxena and Nigam, 2013). This type of sampling was selected because it would help to prevent bias. However, its disadvantage is that it may be very costly. It also may consume time, for example, when sampling respondents who are widely located (Alvi, 2016).

The researcher prepared 267 slips, one hundred and seventy-three slips were written 'YES' and the remaining 94 slips were written 'NO'. They were folded, placed in a box and shuffled. Women from the population drew one slip without looking. A 'yes' slip meant that the woman would participate in the research and a 'no' slip meant that the woman would not participate. The slips were drawn until all 267 slips were finished.

3.7. Inclusion criteria

This study only covered women who were permanent residents of Mpheni village because they were the ones who experience the water shortage on a day to day basis.

3.8. Exclusion criteria

Any woman who met the criteria but who was not a permanent resident was not part of the study, in order to limit bias.

3.9. Instrumentation

Questionnaires were used. A questionnaire refers to a list of written questions which require the respondent to record the answers (Kumar, 2011). The questionnaire was based on the literature and guided by the Health Belief Model. Close-ended questions and open-ended questions were used in the questionnaire. Close-ended questions might limit the participants in the sense that the experience they might have had might be lost. However, open-ended questions supplemented them, so that more data was collected. The questionnaires were written in Venda, in order to accommodate the favourable language of the respondents who might not be fluent in English.

Refer to Appendix 1 for the questions which were asked in the questionnaire. The questions started with section A for socio-demographic information, section B for factors contributing to water shortages, section C for physical health effects and section D for psychosocial factors.

3.10. Pre-test of the research instrument

Pre-testing for this research was carried out by administering five questionnaires to five women in the nearby village of Magangeni. The village also has a water shortage problem. The researcher rectified the mistakes and added where it was necessary. The pre-test results from Magangeni Village did not form part of the actual research results. They were only used to check if the questions were feasible.

3.11. Reliability and validity of Data

Validity refers to the integrity and application of the methods used and the accuracy with which the research findings produce the data (Smith and Noble, 2015). In this study face validity and content validity were considered.

3.11.1. Face Validity

Face validity judges whether an instrument or test seems to measure what it is intended to measure (Lane, 2013). The researcher submitted the proposal to the supervisors and research experts, so that they read it through and ensured that there were no errors in spelling and ambiguities. They also checked the length and structure of the questionnaire and questions.

3.11.2. Content validity

Content validity refers to the ability of the selected items to reflect the features of the construct in the measure (Zamanzadeh, Rassouli, Abbaszadeh, Majd, Nikanfar and Ghahramanian, 2014). To ensure content validity, the researcher submitted the questionnaire to the supervisors and research experts, so that they could check if the content of the questionnaire is aligned to the objectives of the study.

3.11.3. Reliability of instrument

Reliability is defined as the extent to which a research instrument produces similar results if it is used in the same situation consistently. It is applied to make sure that the questionnaire that is used to gather information is able to obtain the same results each time it is used (Heale and Twycross, 2015). The researcher tested the reliability of the questionnaire by asking the same questions over and over and checking whether similar responses would arise. Therefore, the test-retest method was used to determine the reliability of the instrument.

3.12. Data collection

Data collection is defined by Kabir (2016) as the process of gathering and measuring information on variables of interest systematically in order to answer research questions, test hypothesis and evaluate the findings.

3.12.1. Recruitment process

The researcher sought permission to conduct a cross-sectional survey at Vhutuwangadzebu section at Mpheni Village from the Chief and to notify her before commencing. The researcher also asked the Chief to call a meeting of women from Vhutuwangadzebu section. The women were given information letters pertaining to the purpose of the research and drew slips for participation. Those who were selected were given questionnaires to fill at home when they were free. The researcher gave the respondents information on how to fill them. They also signed the informed consent form to show that they agreed to participate. The respondents were asked to register their names and contact numbers, so that it might be easy for the researcher to collect the questionnaires.

3.12.2. Procedure of data collection

All selected women filled the questionnaires. The questionnaires were administered in Venda. The researcher collected the completed questionnaire from the respondents' homes. Data collection would take approximately 25 minutes for each respondent to complete the questionnaire. The process of data collection ran for 4 weeks.

3.13. Data management and analysis

The questionnaires were coded, which means no names were recorded. The data was then captured on SPSS (Statistical Package for Social Sciences) version 25.0, using codes and then later on the researcher used Ms Excel to analyse the data. Chi-square test was used to determine the relationship between water shortage and physical health effects, as well as the psychosocial health effects. The significance level was fixed at $P \leq 0.05$, which means that any value which was equal to/or less than 0.05 was regarded to have a relationship, while any value above 0.05 was regarded as not having the relationship. Furthermore, the data was presented in the form of graphs, pie charts and frequency tables, so that it could be easily analysed.

3.14. Ethical considerations

Research ethics refer to a moral distinction between right, and wrong, and what is unethical is not necessarily illegal. Ethics in research differs in societies. The researcher ensured that all the necessary ethical issues were followed throughout the study.

3.14.1. Permission

The researcher presented the research proposal to the Department of Public Health and to the School of Health, to ensure its quality. The proposal was also submitted to the University Higher Degrees Committee in order to seek approval to conduct it. In addition, the researcher sought ethical clearance from the Ethics Committee at the University of Venda. The researcher also requested that the chief of Mpheni Village grant permission to conduct the survey at Vhutuwangadzebu section.

3.14.2. Consent form

The respondents were fully informed about what is expected from them and were also conversant about the nature of research they are going to be involved in. Thereafter, they were given an informed written consent form, in order to ensure that the respondents did not feel obliged to participate in the study. An information letter was attached, along with the consent form to let the respondents understand the aim of the study, objectives of the study, and benefits of participating in the study. Only respondents who agreed and signed the consent form were part of the research.

3.14.3. Privacy

Privacy is a generally accepted social norm about the individual expectations about what information about oneself should or should not be known by other people. It is a significant right in a free and democratic society. Privacy includes the necessity to feel safe and a private physical place in which the study occurs (Powell, 2012). The researcher ensured the privacy of the respondents by collecting data in their homes during the study.

3.14.4 Confidentiality and anonymity

Confidentiality is all about who has the right of access to the data provided by the participants (Houston, 2016). The researcher ensured that the information provided on the questionnaire by the respondents was kept safe and was not given to any person. The researcher also ensured that the information that the respondents provided was not used against them. Anonymity is concerned with the concealing of the identities of participants in all documents resulting from the research (Houston, 2016). In this research study anonymity was ensured by making sure that the names provided on the questionnaire were not captured and displayed on the data analysis but were replaced by codes so that there would be no link between the respondents and the information.

3.14.5. The principle of respect for human dignity

The principle of respect for human dignity is the principle that ensures that the researcher has the ability to control her own actions and requirements to obtain informed consent (Artal and Rubenfeld, 2017). It includes two components.

3.14.5.1. Right to full disclosure

Full disclosure means that the researcher must clearly share the length of the time of participation, scope and the nature of the respondent's involvement. The researcher fully informed the respondents regarding the study in relation to the nature, duration and purpose of the study before they signed the consent form. Respondents were also informed about the methods, processes and procedure of data collection and how findings of the study would be used.

3.14.5.2. Voluntary participation

Voluntary participation means that respondents have the right not to answer specific questions and that they have the right to withdraw at any point during the research process without prejudice (Depoy and Gitlin, 2016). The researcher ensured that the respondents understood that the study was voluntary.

3.15. Plan for dissemination and implementation of results

The researcher ensured that the research hardcopy was made available to the Library Section at the University of Venda, where students would be able to access and use it. The study findings might be presented at conferences, seminars and published in accredited journals.

3.16 Conclusion

This chapter discussed the theoretical framework for this study, which is the Health Belief Model. The study followed the quantitative research design. The chapter also covered study setting, study population, sampling, inclusion and exclusion criteria, instrumentation, pre-testing of the research instrument, validity and reliability of instrument, data collection, data management and analysis, ethical considerations, plan for dissemination and implementation of results. The next chapter focused on presentation of the results of the cross-sectional survey and discussion.

CHAPTER 4

Presentation of results and discussion

4.1. Introduction

The previous chapter discussed the research methodology for this study. This chapter contains the results of the survey which is from data analysis. It includes the results on socio-demographic characteristics of the respondents, factors contributing to water shortage, physical health effects and psychosocial health effects of water on women at Vhutuwangadzebu section in Mpheni Village. It also includes the results of the relationship between water shortage and physical health effects as well as psychosocial health effects. Moreover, the findings of this research are discussed and compared and contrasted with other findings from other researchers.

4.2. Socio-demographic characteristics

One hundred and seven three questionnaires were distributed among the respondents from Vhutuwangadzebu section at Mpheni Village. All of the questionnaires were completed. Table 4.1. shows the socio-demographic characteristics of the respondents from Vhutuwangadzebu section. They comprise of age, educational level, employment status and source of income. Their age range from 18 to 68 years. The mean age was 43 years. Of the 173 respondents, the age group 18-28 years was 47(28.3%). Furthermore, 108(62.4%) attended high school as their highest level of education, 87(50.3%) were married and 120(69.4%) were unemployed. Regarding the source of income, 90(52.0%) relied on grant for survival.

Table 4.1. Socio-demographic characteristics (n=173)

Variable	Frequency	Percentage
Age		
18-28	47	27.2
29-38	33	19.1
39-48	24	13.9
49-58	32	18.5
59-68	37	27.4
Educational level		
grade 1-7	20	11.6
grade 8-12	108	62.4
tertiary	31	17.9
did not go to school	14	8.1
Marital status		
Married	87	50.3
Single	80	46.2
Divorced	4	2.3
Widow	2	1.2
Employment status		
Employed	53	30.6
Unemployed	120	69.4
Source of income		
Salary	71	41.0
Grant	90	52.0
Commission	12	6.9

As shown on table 4.2, 45(26.0%) respondents lived in a household size of 4 members and 167(96.5%) had a shortage of water. Among the 173 respondents 98(56.6%) had to buy water from those who have boreholes.

Table 4.2. Socio-demographic characteristics (n=173)

Variable	Frequency	Percentage
Household size		
2 members	3	1.7
3 members	11	6.4
4 members	45	26.0
5 members	42	24.3
6 members	30	17.3
7 members	24	13.9
8 members	16	9.2
9 members	1	.6
15 members	1	.6
Water shortage		
Yes	167	96.5
No	6	3.5
Source of water		
Own borehole	6	3.5
Buy borehole water	98	56.6
Communal water	43	24.9
River water	26	15.0

4.3. Factors contributing to water shortage

The study assessed the distance that the respondents travelled to the water source, water quality, views on water shortage factor, municipal staff technicality, unhealthy water and water purification.

4.3.1. Distance

On the frequency table 4.3., it is shown that 34(19.7%) respondents travelled 1 km to the source of water. The mean distance that the respondents travelled was 1.11705 km.

Table 4.3. Distance from the water source to the respondent's house (n=173).

Variable	Frequency	Percentage
Distance in metres		
10	6	3.5
100	4	2.3
110	1	0.6
120	1	0.6
150	1	0.6
200	5	2.9
300	6	3.5
400	10	5.8
500	10	5.8
600	10	5.8
700	2	1.2
800	3	1.7
1000	34	19.7
2000	25	14.5
3000	26	15.0
4000	22	12.7
5000	7	4.0

4.3.2. Perceptions on water quality

Respondents were asked about their views on the quality of the water they use. Of the 173 respondents 104(60%) indicated it was of good quality while 45(26%) and 24(14%) respondents said it was bad and very bad respectively. Please refer to Figure 4.1.

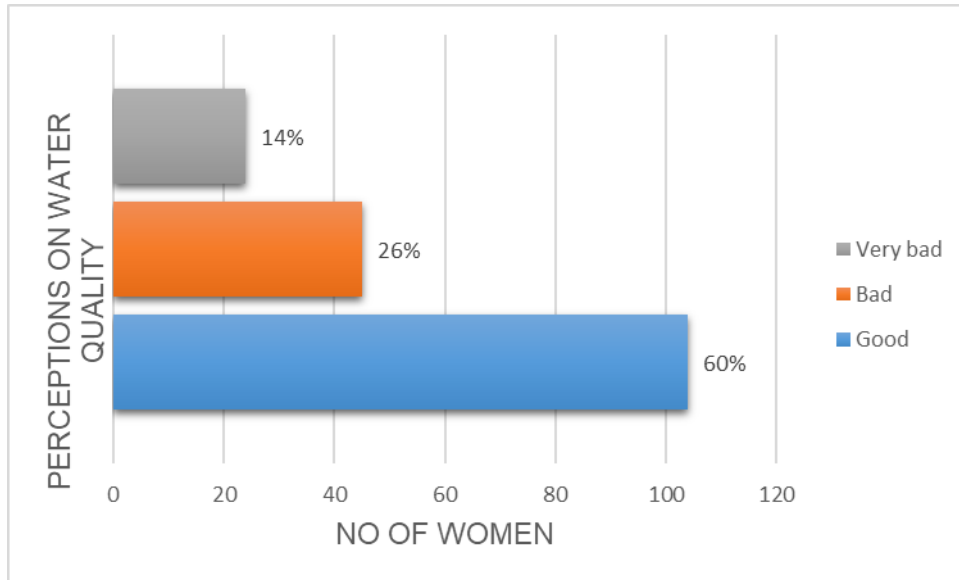


Figure 4.1. Perceptions on water quality

4.3.3. Causes of water shortage at Vhutuwangadzebu

Respondents were asked what could be the cause of water shortage at Vhutuwangadzebu. Figure 4.2. indicates that 140(80.9%) political issues are responsible for water shortage in the area. Other factors responsible for water shortage are irregular supply 28(16.2%) and no municipal service 5(2.9%).

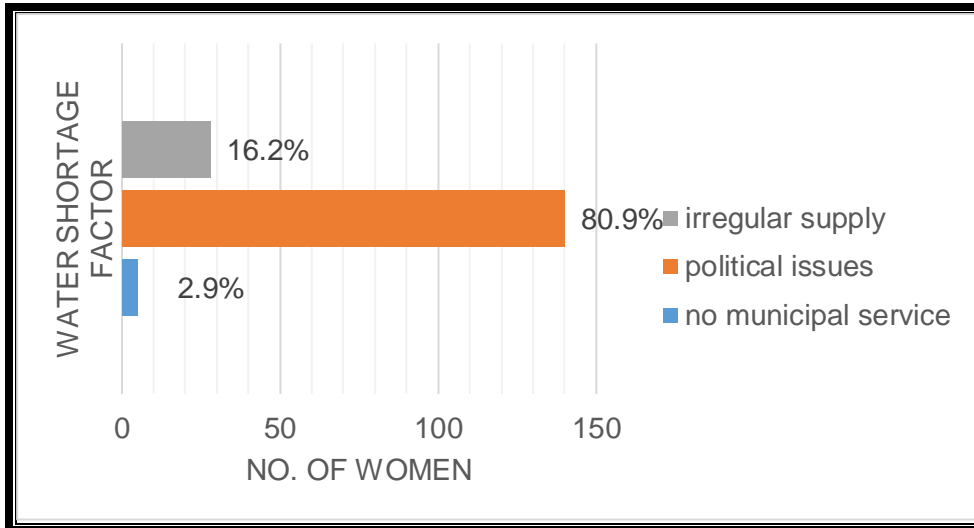


Figure 4.2. Causes of water shortage

4.3.4. Municipal staff technicality

When asked about the staff technicality towards water shortage, respondents 127 (73.4%) indicated that there is a slow response to their complaints while others 46(26.6%) indicated that there is no service at all. See figure 4.3.

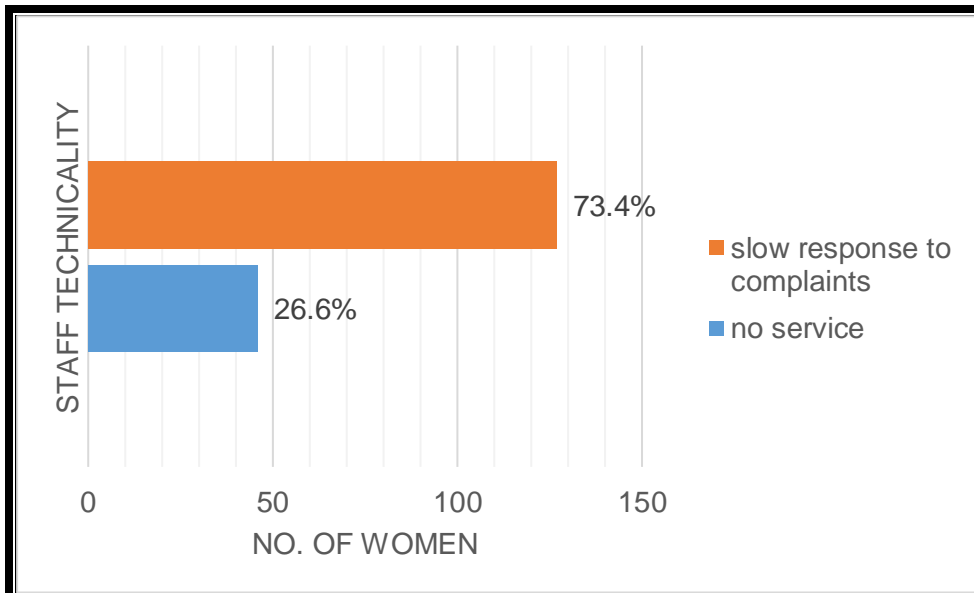


Figure 4.3. Municipal staff technicality

4.3.5. Drinking unhealthy water

Respondents were also asked if they ever drunk unhealthy water due to the shortage of water in their homes, 48(27.7%) said that they did while 125(72.3%) said that they never. Of the 48 respondents who drunk unhealthy water, 29(57%) respondents indicated that they felt weak to go and collect water and that there was no other water to drink, 15(29%) others said that they did not have finances to purchase water from borehole owners and 7(14%) said that the queues were too long. Refer to Table 4.4.

Table 4.4. Drinking unhealthy water

Variable	Frequency	Percentage
Drinking unhealthy water		
Yes	48	27.7%
No	125	72.3 %
Felt weak to go and collect water	29	57%
Did not have finances to to purchase water from borehole owners	15	29%
Queues were too long	7	14%

4.3.6. Water purification

On figure 4.6. it is indicated that 163(94.2%) respondents purify their water while 10(5.8%) do not. Of the 163 respondents who said that they purify their water, 101(58.4%) indicated that they boil it while 62(35.8%) indicated that they use anti-germ products.

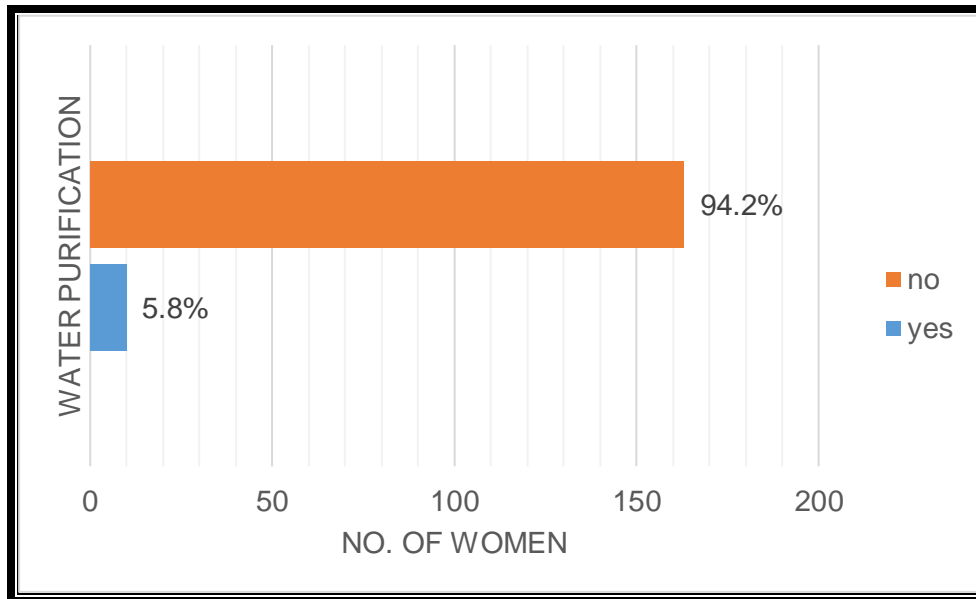


Figure 4.4. Water purification

4.4. Physical health effects of water shortage

This section presented results on the physical health effects that would prevent the functioning of the respondent's physical body due to water shortage. They include diarrhoea, skin rash, tiredness, pain, injury and thirst.

4.4.1. Diarrhoea

As shown on Figure 4.7., 40(23.1%) respondents indicated that they have suffered from diarrhoea after drinking unhealthy water due to the shortage of water at Vhutuwangadzebu section. Majority 133(76.9%) said that they did not suffer from diarrhoea.

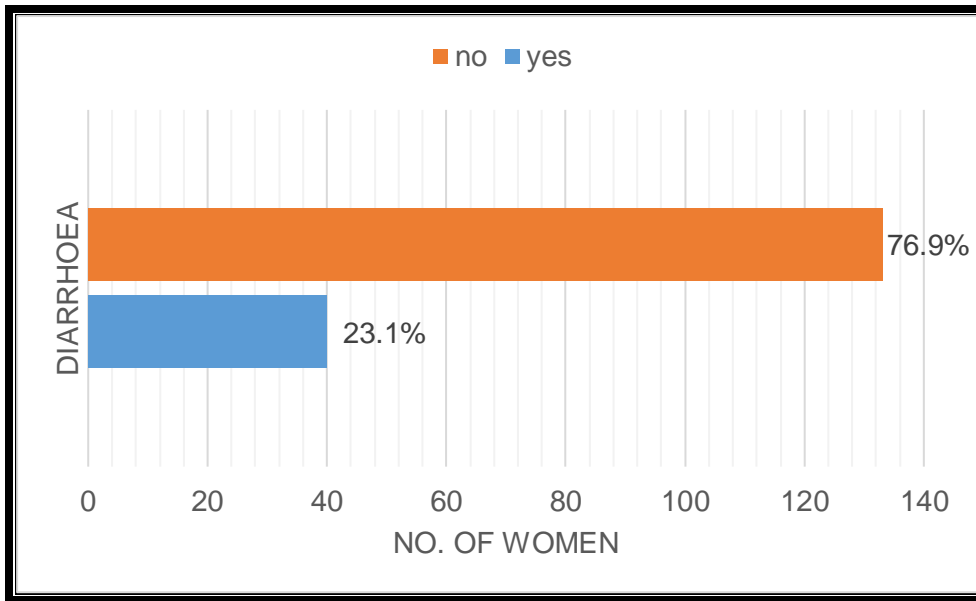


Figure 4.5. Prevalence of diarrhoea

4.4.2. Skin rash

Respondents were asked if they have ever suffered from skin rash after drinking unclean water due to the shortage of water, 14(8.1%) respondents indicated that they did while 159 (91.9%) said that they did not. Figure 4.8. shows the results.

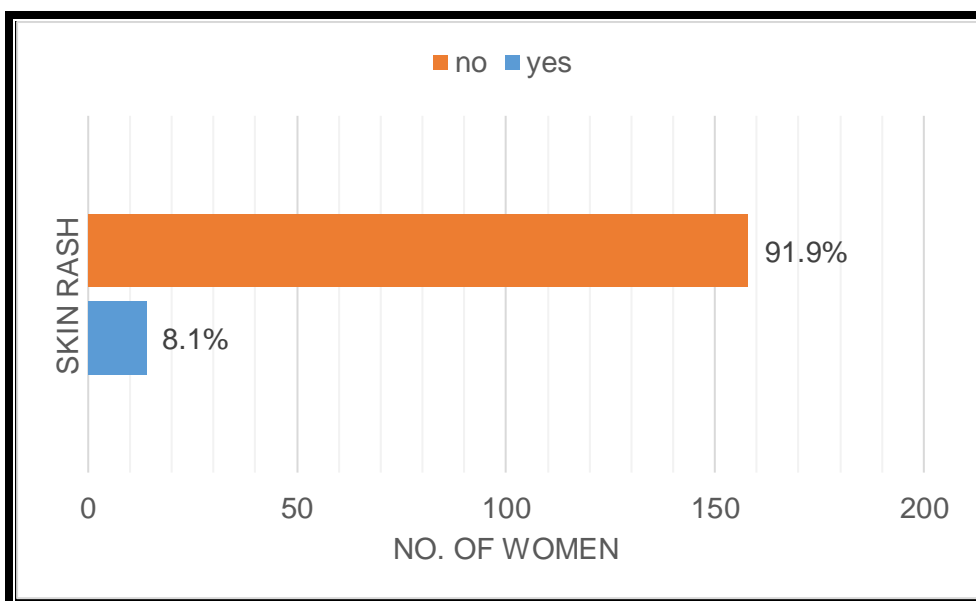


Figure 4.6. Prevalence of skin rash

4.4.3. Tiredness

Respondents were also asked if they have ever got too tired from collecting water outside their home due to the shortage of water, 84(48.6%) respondents indicated that they felt tired while 89 (51.4%) said that they did not. Figure 4.9. shows the results.

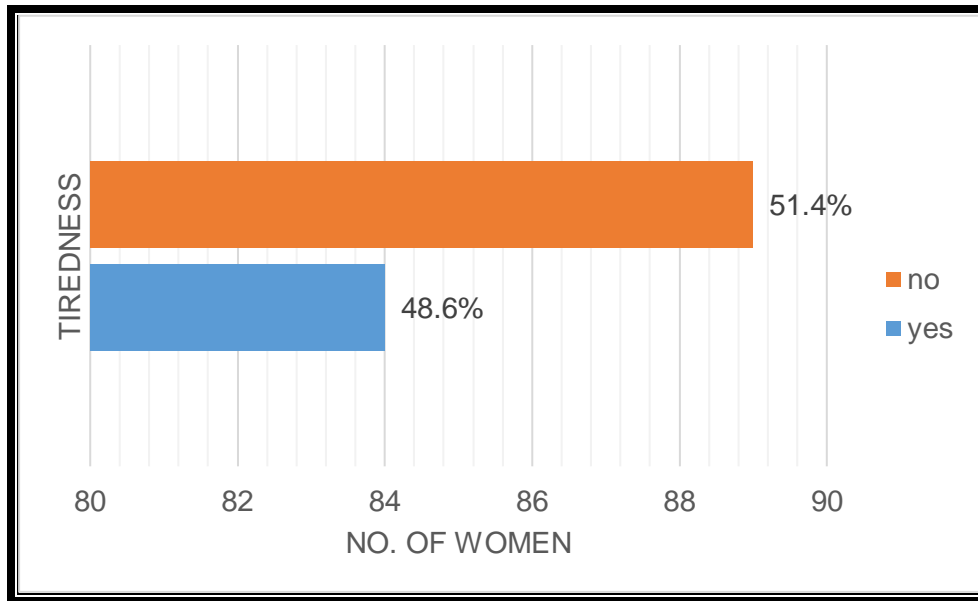


Figure 4.7. Tiredness

4.4.4. Pain

Figure 4.10. represents statistics with regards to pain among the respondents. It is indicated that 61(35.3%) respondents suffered from pain after collecting water outside their homes whereas 112(64.7%) respondents did not.

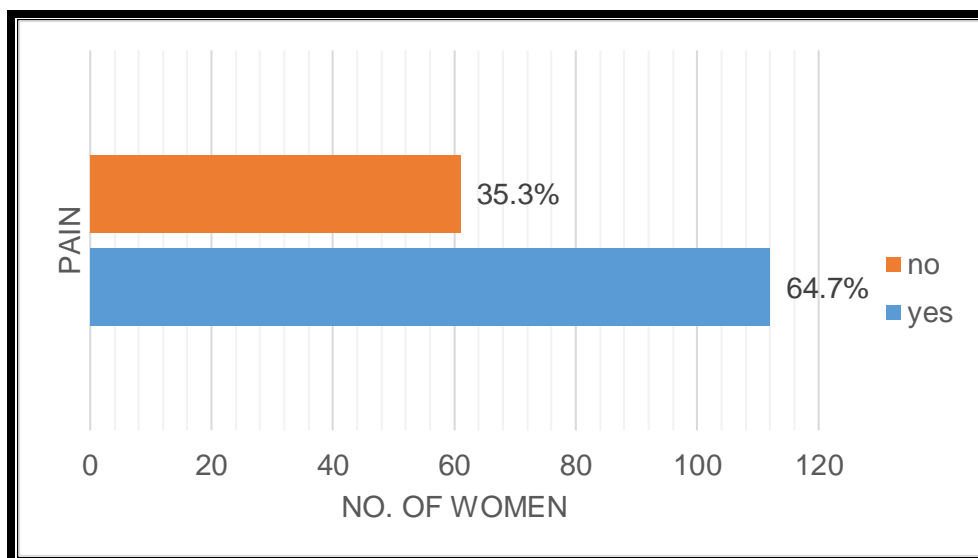


Figure 4.8. Pain

4.4.5. Injury

The cross sectional survey results also indicate that 17(9.8%) respondents got injured while collecting water from the source whereas 156(90.2%) respondents did not get injured. Of the 17 respondents 8(47%) slip and fell, 4(23%) stepped on a thorn, 3(18%) stepped on broken bottles while 1(6%) got bitten by a snake and a dog respectively. Refer to Table 4.5.

Table 4.5 Injury

Variable	Frequency	Percentage
Injury		
Yes	17	9.8%
No	156	90.2%
Slip and fell	8	47%
Stepped on a thorn	4	23%
Snake bite	1	6%
Dog bite	1	6%
Stepped on broken bottles	3	18%

4.4.6. Thirst

Respondents were asked if ever they slept thirsty because of shortage of water. On figure 4.9., it is indicated that one hundred and forty-nine (86%) of them have never went to sleep thirsty. Only 24(13.9%) respondents indicated that they have went to sleep thirsty.

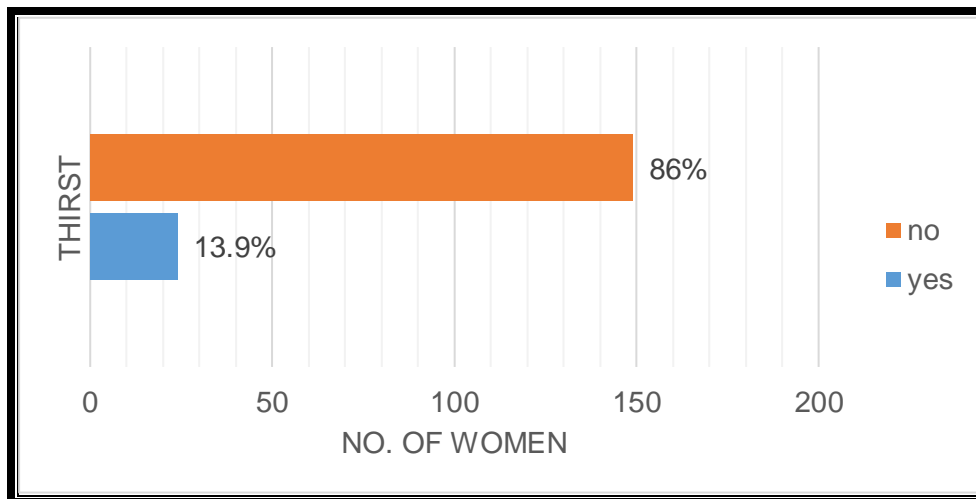


Figure 4.9. Thirst

4.5. Psychosocial health effects of water shortage

This section presented the results on psychosocial health effects experienced by the respondents due to water shortage. They include financial stress, worry, quarrel with others or with family members, not being able to socialize, anger, shame, verbal assault, physical assault and safety.

4.5.1. Financial stress

Hundred and seven respondents indicated that they did not suffer from financial stress when they have to use the money to buy water. See Figure 4.10. only 66(38.2%) respondents indicated that they have suffered a financial stress because of buying water.

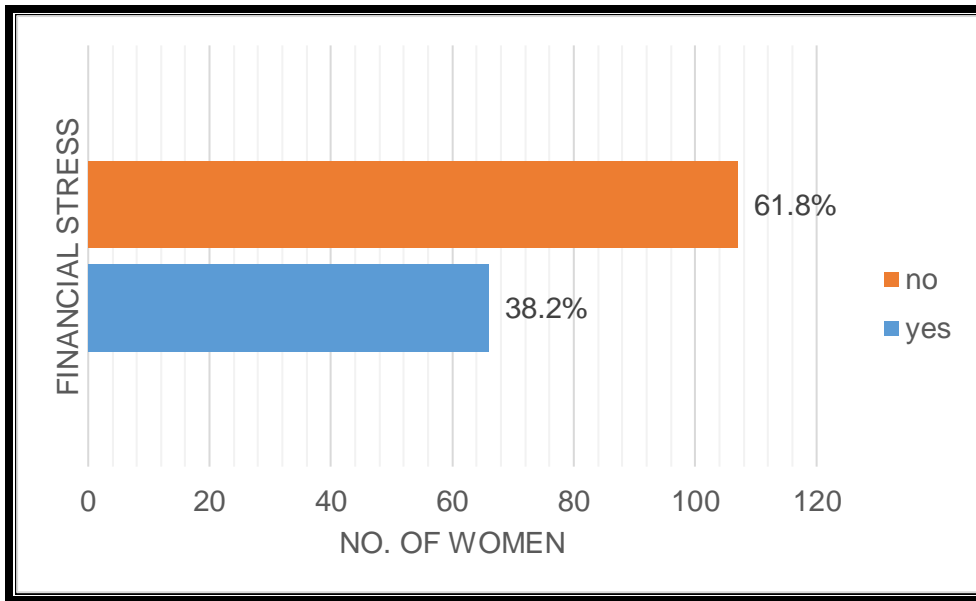


Figure 4.10. Financial stress

4.5.2. Worry

Regarding worry, 92(53.2%) respondents indicated that they worried about the insufficient quantity of water in their household. Only 81(46.8%) indicated that they did not. Refer to Figure 4.11.

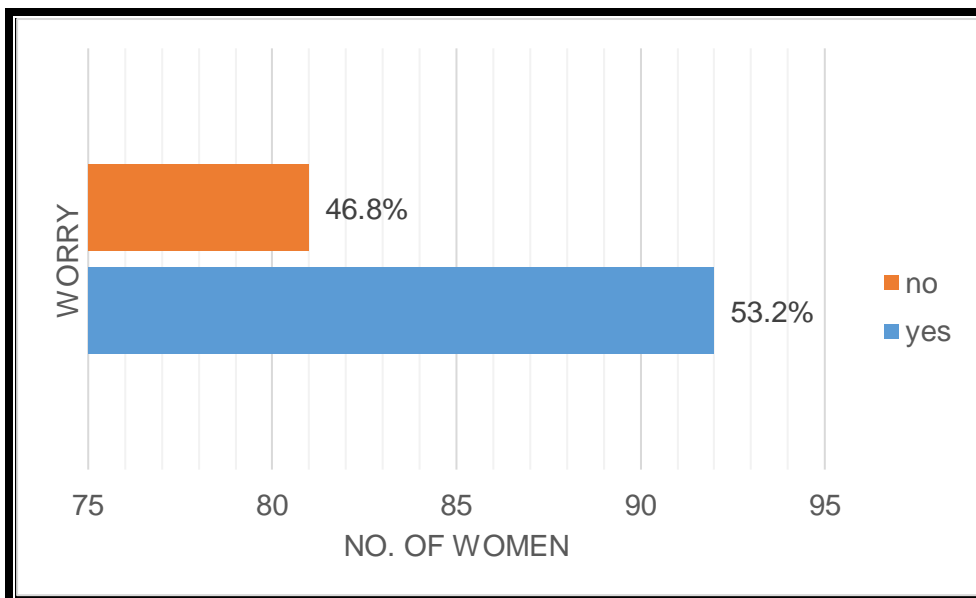


Figure 4.11. Worry about insufficient quantity of water

4.5.3. Quarrelled with others over water collection queuing

Hundred and twenty-seven respondents indicated that they did not quarrel with others over water collection queuing. See Figure 4.12. only 46(26.6%) respondents indicated that they did.

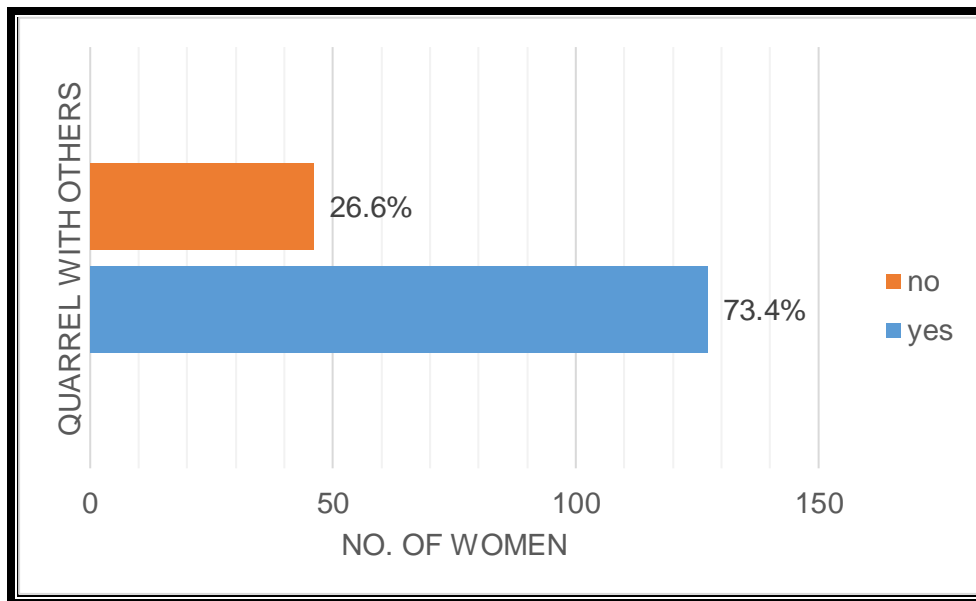


Figure 4.12. Quarrelled with others over water collection queuing

4.5.4. Quarrelled with family member for not completing house work

Respondents were asked if ever they quarrelled with family member for not completing house work. On Figure 4.13, the cross sectional survey results showed that 157(90.8%) respondents did not whereas 16(9.2%) did quarrel with a family member for not completing house work due to shortage of water in the household.

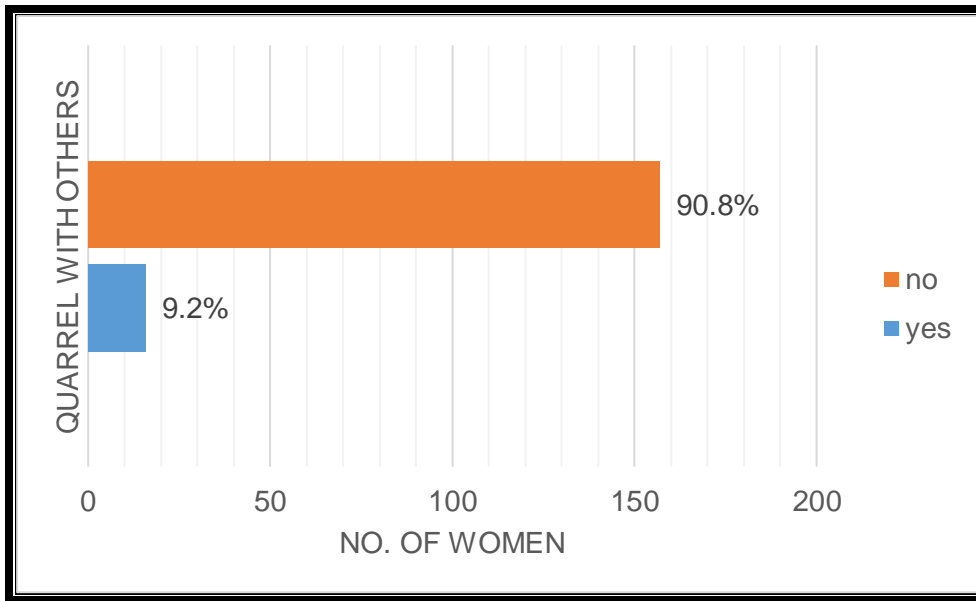


Figure 4.13. Quarrelled with family member for not completing house work

4.5.5. Social relation

As indicated in the bar graph on Figure 4.14., 131(75.7%) respondents showed that they did not socialise with other people in a sense that they failed to participate in church, funeral, wedding or meeting because they had to be collecting water.

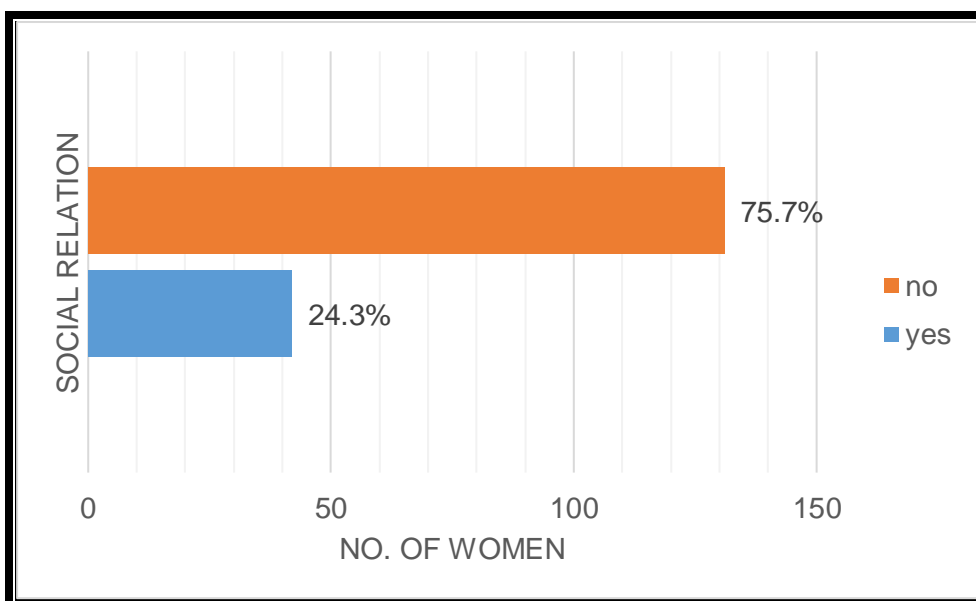


Figure 4.14. Social relation

4.5.6. Anger

Figure 4.15. represents the statistic results with regard to anger among the respondents. One hundred and fourteen (65.9%) respondents indicated that they felt angry because of the shortage of water in their house. Only 59 (34.1%) respondents did not experience it.

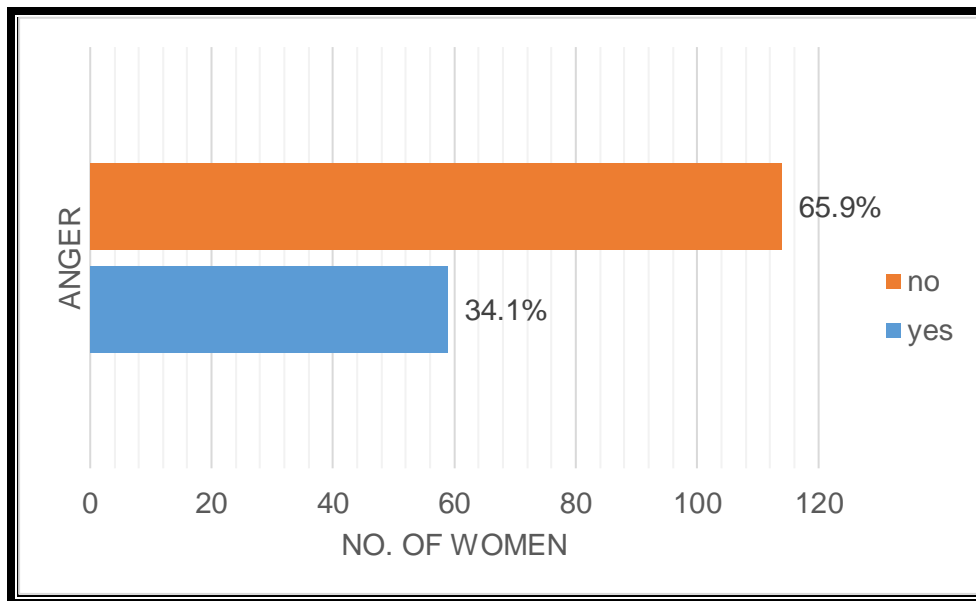


Figure 4.15. Anger

4.5.7. Shame

The cross sectional survey results also indicate that 107(61.8%) respondents did not experienced shame due to water shortage in their household whereas 66(38.2%) experienced it. Of the 66 respondents 17(25%) have sent children to school with dirty faces, 35(51%) felt shame at appearing unclean to others and 4(6%) could not clean the house, 9(13%) could not offer guests drinking water, 2(3%) could not wash hands after coming from the toilet and only 1(2%) could not cook. See Table 4.6.

Table 4.6. Shame

Variable	Frequency	Percentage
Shame		
Yes	66	38.2%
No	107	61.8%
I have sent children to school with dirty faces	17	25%
At appearing unclean to others	35	51%
Could not clean the house	4	6%
Could not offer guests drinking water	9	13%
Could not wash hands after coming from the toilet	2	3%
Could not cook	1	2%

4.5.8. Verbal assault

Figure 4.16. shows that one hundred and twenty-seven respondents indicated that they have not suffered from verbal assault while collecting water from the source, whereas 47(27.2%) suffered.

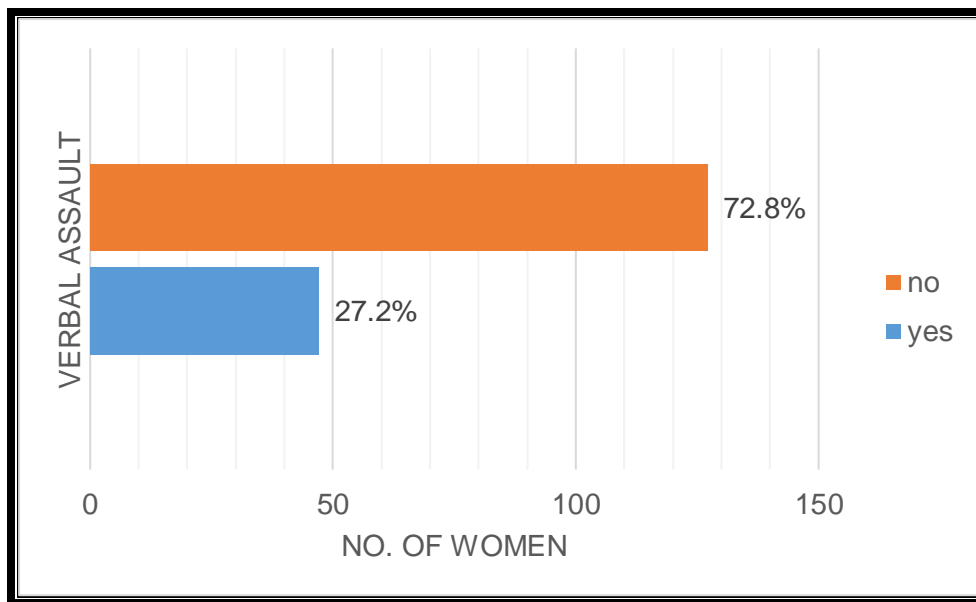


Figure 4.16. Verbal assault

4.5.9. Physical assault

The survey results also indicate that 147(85.0%) respondents have not suffered from physical assault due to water shortage whereas 26(15.0%) did. Of the 26 respondents 20(77%) said that they fought with people while queuing at the water source and 6(23%) have said that their husband or family member hit them when they could not cook because of water shortage. See Table 4.7.

Table 4.7

Variable	Frequency	Percentage
Physical assault		
Yes	26	15.0%
No	147	85.0%
I fought with people while queuing at the water source	20	77%
Husband/family member hit me when I could not cook because of water shortage	6	23%

4.5.10. Safety

Table 4.8. represents the statistical results with regards to safety among the respondents. One hundred and twenty-five, (72.3%) respondents did not feel safe when going to collect water whereas only 48(27.7%) felt safe. Of the 125 respondents 46(37%) said that there are criminals who take their belongings including cell phones and money, 24(19%) feared dogs, 17(14%) feared dagga smokers because they may do anything bad against them as they do not think positively and 8(6%) feared snakes and rape respectively.

Table 4.8. Safety

Variable	Frequency	Percentage
Safe		
Yes	48	27.7%
No	125	72.3%
Criminals took our belonging	46	37%
Feared dogs	24	19%
Feared dagga smokers	17	14%
Feared snakes	8	6%
Feared of rape	8	6%

4.6. Association between water shortage and health effects

Under this section 4.6.1. presented results on the relationship between water shortage and physical health effects that the respondents experienced. Additionally, 4.6.2. presented results on the relationship between water shortage and psychosocial health effects that the respondents experienced. Chi square test was run and results were presented as follows:

4.6.1. Relationship between water shortage and physical health effects

The chi square test for this study indicated that there was no significant relationship between the water shortage and physical health effects (diarrhoea, skin rash, tiredness, pain, injury, thirst), refer to Table 4.9.

Table 4.9. Relationship between water shortage and physical health effects

Variable		Water shortage		Total	P-value $P \leq 0.05$
diarrhoea		yes	no		P=0.172
	yes	40	0	40	
	no	127	6	133	
Total		167	6	173	
Skin rash	yes	14	0	14	P=0.459
	no	153	6	159	
Total		167	6	173	
tiredness	yes	81	3	84	P=0.943
	no	86	3	89	
Total		167	6	173	
Pain	yes	59	2	61	P=0.920
	no	108	4	112	
Total		167	6	173	
Injury	Yes	17	0	17	P=0.411
	no	150	6	156	
Total		167	6	173	
Slept thirsty	yes	23	1	11	P=0.006
	no	144	5	162	
Total		167	6	173	

4.6.2. Relationship between water shortage and psychosocial health effects

The chi square test for this study also indicated that there was no significant relationship between most of the psychosocial health effects (financial stress, worry, quarrel with others over queuing at the water source, quarrel with husband/family member over not completing household work, not socialising, anger, shame, verbal assault, physical assault) and water shortage. However, it showed a very strong significant difference between water shortage and safety ($P= 0.000$), refer to Table 4.10.

Table 4.10. Relationship between water shortage and psychosocial health effects

Variable		Water shortage		Total	P-value $P \leq 0.05$
Financial stress		yes	no		P=0.805
	yes	64	2	66	
	no	103	4	107	
Total		167	6	173	
Worry	yes	90	2	92	P=0.321
	no	77	4	81	
Total		167	6	173	
Quarrel over water queuing	yes	45	1	46	P=0.573
	no	122	5	127	
Total		167	6	173	
quarrel over unfinished household work	yes	16	0	16	P=0.426
	no	151	6	157	
Total		167	6	173	
Not socialising	Yes	40	2	42	P=0.598
	no	127	4	131	
Total		167	6	173	
Anger	yes	57	2	59	P=0.968
	no	110	4	114	
Total		167	6	173	
Shame	yes	64	2	66	P=0.805
	no	103	4	107	
Total		167	6	173	
Verbal assault	Yes	45	2	47	P=0.730
	no	122	4	126	
Total		167	6	173	
Physical assault	yes	26	0	26	P=0.294
	no	141	6	147	
Total		167	6	173	
Safety	yes	42	6	48	P=0.000
	no	125	0	125	
Total		167	6	173	

4.7. Discussion

In this section, the findings of the study are discussed, compared and contrasted with other research findings by other researchers in the world.

4.7.1. Socio-demographic characteristics

The total number of respondents for this study were 173. Their age ranged from 18 to 68 years and their mean age was 43 years. Of the 173 respondents, the majority ranged in age from 18-28 years. The results also showed that **majority** of respondents have attended high school as their highest level of education.

Majority of respondents were married and were unemployed. Most of them relied on grant as their source of income. Quarter of the respondents lived in a household size of 4 members and had a shortage of water. Among the 173 respondents **more than half** bought water from those who had boreholes.

The findings of the study are confirmed by those from the previous studies. Bapat and Agarwal (2003) revealed that poor women from slums in Mumbai and Pune payed those who had taps so that they can get water for their families. The cost of coping with water shortage is too high for poor families. A study in Kathmandu Valley by Molden, Khanal and Pradhan (2018) showed that the burden of coping with water shortage is huge especially because in one household there were many families and one person who was the bread winner was supposed to use their money to buy water for the whole household.

4.7.2. Factors contributing to water shortage at Vhutuwangadzebu

The first objective was to assess the factors contributing to water shortage at Mpheni Village. The findings of the survey showed that distance, water quality, political issues, municipal staff technicality, unhealthy water and water purification were the factors that contributed to water shortage at Vhutuwangadzebu. The results are as follows:

Access is the availability of 20L of water per person per day from an improved source (WHO, 2015). The finding of this study showed that the **most** of the respondents travelled 1 km to the

source of water to collect water. The mean distance travelled by the respondents was 1.11705 km that is beyond what is mentioned by WHO, that it should be within 1km. The findings of this study are confirmed by some researchers.

Mkonda (2015) showed that in **Dodoma, Tanzania** half of the respondents indicated that they travelled more than 3k to fetch water. The water sources were not near their homestead. In rural India (39.8 %) women reported fetching water from a distance of 51–500 meters. However, some travelled up to 2 km to fetch water outside their village. Sometimes women were forced to travel more than 500 meters several times in a day with pots on their heads in order to collect drinking water and that made them to suffer from pain (Dutta, Sinha and Parashar, 2018).

When looking at the respondent's perceptions on the quality of water **more than quarter** of the respondents said that the quality of water was bad while the **majority** said that the quality of water was good. That is confirmed by a study in Surat City by Buch, Damor, Moitra and Khatib (2019). The study indicated that among 140 households, only 1.4 % reported that the quality of water had bad appearance. Majority of the respondents did not have complaints about the quality of drinking water.

In the North West province, 1000 respondents were requested to rate the quality of the water in their communities. The majority indicated that the water quality in their area was average while the other group indicated that their water was of good quality. Minority of the respondents indicated that their water quality was poor or excellent (Coetzee, Nell and Bezuidenhout, 2016).

Majority of respondents in this study indicated that political issues were responsible for water shortage at Vhutuwangadzebu in Mpheni Village. Kujinga, Vanderpost, Mmopelwa, Wolski, (2013) revealed that there had been constraints of reliable water supply in Ngamiland in Botswana over the past years. Government financial resources through DWA and the NWDC were limited. These financial resources were necessary in order to purchase and install infrastructure as well as its operation and maintenance. Constraints by finances had a negative impact on the households. Personnel from NWDC mentioned that funding for water supply was inadequate (Kujinga, Vanderpost, Mmopelwa and Wolski, 2013).

Hunter, MacDonald, Carter (2010) explained that it is not only the limited effectiveness of the Ministries and local government authorities that affects the supply of water but also exacerbation of inadequate political commitment at the highest governmental levels. Toppo

(2015) maintained that there had been an economic burden on local households and communities of Hashemite that has been associated with increased water costs. Toppo (2015) further argued that there also had been an increase in number and intensity of public demonstrations and strikes since the beginning of the arrival of the Syrian population in the area. Water shortage and political agitation were strongly related to the local differences in the effects of water shortages and the effects of uneven water policy on the regional level.

Olivier (2017) argued that Cape Town's water crises were hardly a matter of rainfall but of politics. Cape Town is located in the Western Cape. The only province in South Africa that is run by an opposition party, the Democratic Alliance. Olivier revealed that the shortage of water is blamed on wasteful expenditure in the Department of Water and Sanitation at the national level, (40%) allocation of resources of water to agriculture as well as failure to respond to provincial and municipal demands for help during drought disaster.

The findings of this study showed that **majority** of respondents indicated that there was a slow response to their complaints by the municipal staff. These findings are confirmed by the study by Hoffman and Nkadimeng (2016). The study indicated that (54%) respondents from Motetema settlement in Limpopo showed that there was a slow response to breakdown by the municipal staff that lead to water shortage in that area.

The results of this study showed that **more than quarter** of the respondents have drunk unhealthy water because of shortage of water at Vhutuwangadzebu. WHO (2014) confirms these findings in a study in Bangladesh. It was indicated that due to floods that affected the sources of water in that area, women drunk unhealthy water from polluted wells. That caused the people to suffer from skin problems. In their study in rural India, Dutta, Sinha and Parashar (2018) found that among the households which depended on unsafe sources, only 74.0 % that accessed drinking water from open wells, followed by 20.2 % who depended on river/streams/*nalas* and the rest 5.8 % got their water from springs, ponds and other sources

In this study it is indicated that **minority** of the respondents do not purify their water before they use it. Similar to these findings, in a study conducted by Adams (2017) it was uncommon for majority households in the urban informal settlements of Lilongwe in Malawi to purify water before they use it. When 10(5.8%) respondents were asked why they did not purify the water the reason was that they had no money to buy anti-germ product.

Contrary to that, majority (70%) of respondents in Surat City purified their water by adding chlorine or bleach, (49%) boiled the water and (2%) used a filter, such as coal, sand or cloth (Buch et al., 2019). Buch et al. (2019) assumed that the difference in the water purification practices might be due to technological advancement and economic development of the area.

4.8. Physical health effects of water shortage

The second objective was to determine the physical health effects of water shortage among women at Mpheni Village. The chi square test for this study indicates that there was no significant relationship between the water shortage and physical health effects among women at Vhutuwangdzebu (diarrhoea, skin rash, tiredness, pain, injuries and thirst),

Nearly quarter of the respondents indicated that they have suffered from diarrhoea after drinking unhealthy water due to the shortage of water at Vhutuwangadzebu section. The chi square test showed no significant difference between water shortage and diarrhoea. Similarly, a study in Peru at Shilla and Carhuaz by Anderson (2016) showed that 19 out of 38(50%) Shilla residents suffered from diarrhoea episode after drinking untreated water. It also showed that 4 out of 32 (12.5%) residents of Carhuaz also suffered from diarrhoea after drinking untreated water.

Khan, Shahnaz, Jehan, Rehman, Shah and Din (2013) revealed that in Charsadda district, people were supplied with untreated water. Furthermore, a large number of boreholes were installed without considering issues like depth of the borehole, lining and the distance from the sewage system. That lead people to suffer from diarrhoea including women. During the survey it was found that (47%-49%) respondents reported diarrhoea. Infectious diarrhoea, repeat or chronic diarrhoea episodes are caused by poor water supply. It may arise from chemical species for example, arsenic and fluoride (Hunter, MacDonald and Carter, 2010).

The study results showed that minority of the respondents suffered from skin rash after drinking unclean water. This is confirmed by a study by Liefferink, Van Eeden and Wpener (2017) that indicated that minority of the respondents from Wonderfonteinspruit in Gauteng, South Africa suffered from skin problem after drinking water from polluted Donaldson Dam. Contrary to that a study by Senanayake, Thirumarpan and Thiruchelvam (2016) revealed that

majority (81%) of respondents in Gampaha District were affected by skin rash after they have drunk unclean water due to water shortage.

For this study it is indicated that **more than quarter of the** respondents suffered from pain after collecting water outside their homes. The result of this study showed that there was no significant difference between water shortage and pain ($P=0.920$). Some previous studies for example, Asaba et al. (2013) on exploring the gender differences in water collection in Makondo in rural Uganda, also confirmed that women suffered from pain after collecting water from afar. These women experienced chest pain and back pain.

Out of 3,693 Dalit women in rural India, around 85 per cent indicated that they had different kinds of pain due to carrying water regularly. Body ache and pain in hands were indicated to be the most common. Since most women carry water on their head for a long distance, headache and pain in skull were also indicated to be the main types of pain they suffered from (Dutta, Sinha and Parashar, 2018).

Geere, Bartram, Bates, Danquah, Evans, Fisher, Groce, Majuru, Mokoena, Mukhola, Nguyen-Viet, Duc, Williams, Schmidt and Hunter (2018) explained that people who carried water before had increased risk of reporting pain in the hands and upper back as well as people who currently carry water. It was also explained that pain in the head and upper back, chest or ribs, hands, feet and abdomen/stomach, is associated with currently or previously carrying water. People who currently carry water may suffer from pain in the neck, shoulders/arms, lower back and hips/pelvis or legs.

The cross sectional survey results for this study also indicated that **minority** of the respondents got injured while collecting water from the source whereas **majority** of the respondents did not get injured. Of the 17 respondents majority of them slip and fell while minority stepped on thorns, broken bottles and got bitten by a snake and a dog. There was no significant difference between water shortage and injury among the respondents ($P=0.411$).

Asaba, Fagan and Kabonesa (2016) revealed that women reported injuries because the places they travel as they access the water source was hilly, stony and steep slopes and was bushy that lead them to fall, injure themselves and spill the water. Furthermore, it was revealed that women in Uganda suffered from injuries from accidents as they have to cross major roads using bicycles and vehicles going for water collection (Asaba, Fagan and Kabonesa, 2015).

Wood, Douglas, Fiore, Bernier and Chapman (2019) revealed that in South Africa and Ghana those that were more likely to have a higher household water shortage experiences score also experienced injury when collecting water. Wood et al. (2019) also explained that the long term effects of water collection may be soft tissue damage, musculoskeletal damage and effects on the skeletal system. Due to higher potential for malnutrition and poor health people who live in rural areas are often more likely to experience injury when collecting water.

In this study **minority** of the respondents indicated that they have slept thirsty because of the water shortage. There was no significant relationship between water shortage and thirst among the respondents. These findings are confirmed by a study among post-partum women in Western Kenya. It was reported that women who had just given birth slept thirsty because they had no water in the household (Boateng, Collins, Mbullo, Wekesa, Onono, Neilands and Young, 2018).

The result of this study revealed that **more than half** of the respondents indicated that they felt too tired after collecting water from the source. This may be supported by the results that most of them travel 1km to the source. There was no significant difference between water shortage and tiredness for this study. Otufale and Coster (2012) also revealed that majority of women of mixed HIV status in Ogun of Nigeria reported that they felt tired after collecting water. There was also no significant difference between water shortage and tiredness among women of different HIV status. Another study in rural El Salvador by Portillo (2015) showed that female respondents felt tired because of their everyday collection of water practices.

4.9. Psychosocial health effects of water shortage

The last objective was to determine the psychosocial health effects of water shortage among women at Mpheni Village. The chi square test for this study also indicated that there was no significant relationship between most of the psychosocial health effects (financial stress, worry, quarrel with others over queuing at the water source, quarrel with husband/family member over not completing household work, not socialising, anger, shame, verbal assault, physical assault) and water shortage. However, it showed a very strong significant difference between water shortage and safety ($P= 0.000$).

The results of this study indicates that **more than quarter of the** respondents have suffered from financial stress because of buying water. There was no significant association between water shortage and financial stress. Venkatachalam (2015) also revealed that 147(49%) of

the poor people in Chennai City, in India bought water from private vendors in order to meet their needs because there was water shortage. People from low income spent (12%) of their income on water. Maurya, Misra, Anderson and Vashists (2016) also revealed that respondents in Kenya, reported that they got water for their household needs by buying from the mobile vendors causing them a financial stress.

On the contrary, Cook, Kimuyu and Whittington (2016) mentioned that coping costs are higher among larger, wealthier households and the households whose primary source is not at home. Over half of poor households in their sample spent greater than (10%) of their income on water. They further mentioned that households with unprotected private wells spent a lot of money on water storage containers and water treatment because the water quality was not good for consumption. There was a significant difference between cost of coping with water shortage for both who relied on private wells and piped connection. A study in Ibadan, Nigeria by Tvedt, Jakobsson, coopey and Tauris (2006) showed that minority (4.0%) women indicated that they cannot afford the cost of paying water from the municipality.

In this study **majority** of the respondents indicated that they worried about the insufficient quantity of water in their household. Similarly, Wutich (2009) revealed that women in Villa 65 % women in Villa Israel worry about the shortage of water as they use water for different purposes. The result of the study showed no significant difference between water shortage and worry. Stevenson et al. (2012) on the contrary revealed that there was a strong association between water shortage and worry.

Contradictory to this study, a report on 487 household survey reveals that minority of women in Cape Town worry about lack of water while majority 136(51%) did not worry about the lack of water. Furthermore, 39(87%) women in Accra worried about the lack of water while 74(95%) did not worry about lack of water (Harris, Kleiber, Goldin, Darkwah and Morinville, 2015). Harris, Kleiber, Goldin, Darkwah and Morinville (2015) further revealed that in South Africa, women who owned homes were more worried about water than women who did not own homes. People worry about fetching water because they fear sexual assault especially at night.

More than quarter of respondents in the current study indicated that they had quarreled with others over queuing to collect water. This is confirmed by a study by Twagirimana (2014), who indicated that respondents showed that long queuing for water resulted in quarrels with other

people in Kigali City. It was also indicated that 16(9.2%) respondents quarreled with husband or family member over not completing household work because of water shortage. A study by Stevenson et al. (2012) showed that a few (18.4%) women in Ethiopia quarreled with their husbands over not completing house work due to water shortage in their home.

Another researcher confirmed worry concerning water shortage. For example, a study by Jepson and Vandewalle (2016) also revealed that in El Paso households worried with regard to water shortage. The result of the study further revealed that in Hidalgo more than half of the households were worried with regard to water shortage in the area. About half of the female respondents in the rural El Salvador indicated that they worried about access to water (Portillo, 2015). This supports the hypothesis that water shortage has psychosocial effects on the health of women.

In the present study **majority** of the respondents indicated that they had missed the time to socialise in a sense that they failed to participate in church, funeral, wedding or meeting because they had to be collecting water. Naidoo and Wills (2009) state that social health is the sense of having support from family and friends; for example, having someone to talk to or to participate in other activities with other people. For the majority of the respondents the social health aspect of their lives was deprived by the time taken in collection of water during water shortage at Vhutuwangadzebu. This is confirmed by a study by Pahwaringira (2017), who indicated that other women failed to socialise with relatives and friends because they had to be queuing for water for long hours away from home. They were even unable to help their children prepare to go to school.

Possible advantages of socialising happens to families who do not have to spend time carrying water outside their home plots. That is because they spend time in leisure activities. These advantages may include being able to drink and eat, participate in religious and spiritual activities, spending time with other people, doing some phone calls, writing letters, emails, playing sports, and visits or even meeting with other people (Evans, Bartram, Hunter, Williams, Geere, Majuru, Bates, Fisher, Overbo and Schmidt, 2013).

The **majority** of the respondents indicated that they felt angry in this study because of the shortage of water in their houses. The current study also showed that there was no significant difference between water shortage and anger amongst the respondents ($P=0.968$). This is confirmed by other studies. It was also indicated that more than half of the women in Villa,

Israel, experienced anger due to the shortage of water when they had to purchase water, wait at the water source or queue for water. However, the results showed that there was a significant difference between water shortage and anger (Wutich, 2009). Zolnikov and Salafia (2015) also indicated that heads of the households felt angry when there was shortage of water for bathing and washing clothes in Eastern Kenya. Bisung and Elliott (2018) also revealed that a minority of the respondents felt angry about water shortage sometimes or often.

The results of this study indicated that more than quarter of the respondents experienced shame due to water shortage in their households. Boateng et al. (2018) also revealed that a third of the respondents in Western Kenya felt dirty before others because of shame that is caused by water shortage. In the study on emotional reactions to environmental risks, Bóhm (2002) found that a minority of the respondents experienced shame due to water shortage in their homes.

In the current study **more than quarter** of respondents suffered from verbal assault while collecting water. This is confirmed other studies. From 3,693 Dalit women in rural India (88%) women said they suffered from verbal abuse while collecting water from the source (Dutta, Sinha and Parashar, 2018). The type of verbal assault experienced by Dalit women during water collection included abusive language, vulgar comments and scolding (House, Cavi, Sommer and Ferron, 2014). In Hidalgo, a minority of the respondents indicated that they had expressed verbal abuse towards others due to water shortage by saying negative comments towards them (Jepson and Vandewalle, 2016).

In the current study the results showed that minority of the respondents suffered from physical assault due to water shortage. Of the 26 respondents, **majority** of them said that they fought with people while queuing at the water source, while **minority** of them indicated that their husbands or family members hit them when they could not cook because of water shortage. There was no significant relationship between water shortage and physical assault.

In a study **conducted** in Ethiopia by Stevenson, **it confirmed** that water shortage causes domestic disputes, including beatings of the women responsible for water collection. The results of the study further showed that there might be fights with other people in the queues

for water (Stevenson, Greene, Maes, Ambelu, Tesfaye, Rheingans and Hadley, 2012). A study by Tvedt et al. (2006) showed that more than half of the women indicated that they suffered from physical fights when buying water at the public points. In another study in Mumbai and Pune by Bapat and Agarwal (2003) it was reported that fights usually happened when other women jump the water queue. It got worse to the extent that even the police were involved.

The results of the current study indicated that most of the respondents did not feel safe when going to collect water. Of the 125 respondents, majority of the respondents indicated that there were criminals who forcefully took their belongings, including cell phones and money; minority feared dogs and dagga smokers because they were unpredictable. Another few feared snakes and rape respectively. There was a very strong significant difference between water shortage and safety ($P= 0.000$).

This was confirmed by other studies. Krumdieck, Collins, Wekesa, Mbullo, Boateng, Onono and Young (2016) revealed that the majority of pregnant women of mixed HIV statuses reported that they were not physically safe when going to fetch water from the source. Zolnikov and Salafia (2015) also confirmed that the primary water gatherers experienced fear when collecting water from the water source.

4.10. Conclusion

This chapter focused on the presentation of the results and the discussion thereof. It covered the findings on socio-demographic characteristics of the respondents, factors contributing to water shortage in Mpheni village, physical health effects and psychosocial health effects of water experienced by the respondents. It includes the findings on the relationship between water shortage and both the physical and psychosocial health effects of water shortage. The next chapter focuses on the summary, limitations of the study, recommendation and conclusion.

CHAPTER 5

Summary, Limitations, Recommendations and Conclusion

5.1. Summary

To achieve the objectives of this study, 5 chapters were developed. Chapter one discussed the introduction and the background on water shortage and its health effects. The aim and objectives were clearly stated, as well as the hypothesis, which was linked to the objectives. Chapter two reviewed literature related to water shortage and its health effects by other researchers. In Chapter three the study followed a quantitative research design and simple random sampling of 173 respondents. In Chapter four data was analysed and discussed based on the information from the questionnaires filled by 173 respondents. The findings proved that there has been a serious health effects of water shortage in Mpheni Village.

5.2. Limitations of the study

The use of quantitative design to study psychosocial health effects at Vhutuwangadzebu was a limitation because more information might not have been revealed, but if it were an in-depth interview with respondents much information might have been obtained. The study was only conducted at Vhutuwangadzebu section. Therefore, the findings of the study could not be generalised to all women in Vhembe District.

5.3. Recommendations

The recommendations of this study are based on the findings and the objectives that were to be achieved by the study.

- There should be investment in the development of boreholes because many people suffer from water shortage and the majority use their money to buy water from others.
- There should be more involvement of women in the management of the water infrastructure that would be invested, so that they owned it and took care of it.
- Women should be encouraged to practice rainwater harvesting at the household level.

- Public health education and awareness about water purification should be established and maintained.
- To prevent both physical and psychosocial health effects of water shortage the local government should not only deal with how safe the water is, but also on stable distribution systems that will be near to where women live.
- The psychosocial health effects of water shortage should be further investigated, especially on vulnerable persons like pregnant women and children.

5.4. Conclusion

This chapter focused on the summary, limitations of the study, recommendations and conclusion. The conclusion of this study was based on the objectives of the study. The study determined the physical and psychosocial health effects of water shortage among women at Vhutuwangadzebu in Mpheni Village. The results of this study showed that majority 167(96.5%) women suffered from water shortage. Ninety-eight (56.6%) of the women bought water from those who had boreholes. Most of these women travelled more than 1 km to the water source. The results showed that 140(80.9%) of the women indicated that political issues were responsible for water shortage in the area. Very few 10(5.8%) do not purify their water before using it. When looking at the physical health effects, 84(48.6%) women felt very tired after collecting water. Furthermore, majority felt worrisome 92(53.2%) because of water shortage and that implies a very negative psychosocial health effect. There was a very strong significant relationship between water shortage and psychosocial health in that 125(72.3%) women felt unsafe when collecting water. Therefore, water shortage affected the physical and psychosocial health of women at Mpheni Village.

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Appendices

Appendix A: Ethical clearance

Appendix B: Application to request permission from Mpheni village tribal authority

Enq: Ms Vutlhari Olive Mabolani

P. O. Box 1993

Cell no.: 0834236641/0732398624

Elim Hospital

0960

To: Mpheni Tribal Authority

Dear Sir/Madam

REQUEST FOR PERMISSION TO UNDERTAKE A RESEARCH

I Vutlhari Olive Mabolani, a student at the University of Venda would like to ask for permission to undertake research at Mpheni Village. The title of my study is “**Effects of water shortage on the health of women at Mpheni Village, Vhembe District**”. The purpose of this research is to determine the relationship between water shortage and the health of women at Mpheni Village. It will also assess the factors contributing to water shortage at Mpheni Village.

The study will only cover women from Vhutuwangadzebu section because of lack of resources and limited time to complete the research. The participation of these women will be voluntary. Self- administered questionnaires will be used to collect quantitative data from each household. Only one female per household will be allowed to participate. Data will be collected in April 2019. I hope that through the findings of this research the Vhembe District Municipality will use the findings as a useful tool in making informed decision concerning water supply at Mpheni Village.

Researcher: Miss V.O. Mabolani (see above details)

Promoter: Professor S. Maputle (0159628424)

Co-promoter: Mr B.S. Manganye (015962 8424)

I am looking forward to hearing from you

Faithfully

Ms Vutlhari Olive Mabolani

Appendix C: Letter from Chief of Mpheni Village

Appendix D: Information letter and consent form

Appendix E: Questionnaire

Effects of water shortage on the health of women at Mpheni Village, Vhembe District

Researcher: Mabolani V.O.

Supervisor: Prof. Maputle S.

Co-supervisor: Mr Manganye B.S.

Instructions

Please tick **(mark with an X)** on the correct responses and fill in where required.

Section a: Socio-demography

1. Position of the participant in the family

Head	
Child	

2. Age of the participant

18-28 yrs	
29-38 yrs	
39-48 yrs	
49-58 yrs	
59-68 yrs	
69-78 yrs	
79-88 yrs	

3. Educational level

Grade 1-7	
Grade 8-12	
Tertiary	
Did not go to school	

4. Participant's occupation

Employed	
Unemployed	

5. Marital status

Married	
Single	
Divorced	
Widow	

6. What is the source of income for the family?

Salary	
Grant	
Commission	

7. How many people live in this household? _____

8. How many people in the house have paid employment? _____

9. Have you suffered from water shortage in your house?

Yes	
No	

10. If no, how often is water unavailable to you?

hours	
Days	
months	
years	

11. What is your main source of water?

Own borehole	
Buy borehole water	
Communal water	
Water from the river	
Spring water	
Municipal tanker	
Other	

If other, please specify _____

Section b: Factors contributing to water shortage

12. How long do you travel to get water? ___m/ Km

13. In your opinion, what is the quality of the water you drink?

Good	
Bad	
Very bad	

14. What are the factors contributing to water shortage in the village?

Irregulay supply	
Broken infrastructure	
Political issues	
Theft	
Contamination	
Other	

If other, please mention

.....

15. What is your view regarding the efficiency of the municipality's technical staff in relation to water shortage?

There are too few skilled personnel	
Lack of training	
Slow response to complaints of water infrastructure breakdowns	
Other	

If other, please specify _____

16. Have you drunk water that you thought might not be unhealthy?

Yes	
No	

17. If yes, why did you drink unsafe water?

Felt too weak to go and collect water and it was the only water I had	
I did not have the money to buy water from neighbours	
The queues were too long	
Other	

If other, please specify _____

18. If it is unsafe water to drink, do you sterilize it before you use it?

Yes	
No	

19. If no, what barriers prevented you from sterilizing it

I had no money to buy anti-germ product/sterilizing products	
I did not know how to sterilize it	
Other	

If you answered other, please specify _____

20. If yes, how do you sterilize it?

Anti-germ product	
Boil	
Sun heat	

Section c: Physical health effects of water shortage

21. Have you suffered from diarrhea from drinking unsafe water?

Yes	
No	

22. Have you suffered from cholera from drinking unsafe water?

Yes	
No	

23. Have you suffered from skin rash from drinking unsafe water?

Yes	
No	

24. Have you suffered from eye infection from drinking unsafe water?

Yes	
No	

25. Have you suffered from bilharzia from drinking unsafe water?

Yes	
No	

26. Have you felt too tired after collecting water from the source?

Yes	
No	

27. Have you felt some pain from collecting water?

Yes	
No	

28. Have you got hurt/injured while collecting water from the source?

Yes	
No	

29. How did you get hurt/ injured?

Slip and fell	
Snake bite	
Dog bite	
Other	

If other, please specify? _____

30. Have you suffered from accidents while collecting water from the source?

Yes	
No	

31. Have you ever gone to sleep thirsty because of water shortage?

Yes	
No	

Section d: Psychosocial health effects of water shortages

32. If you had to buy water, have you suffered from financial stress?

Yes	
No	

33. Have you been worried that the quantity of water available would be inadequate for all your needs?

Yes	
No	

34. Have you ever quarreled with others over queuing to collect water?

Yes	
No	

35. Have you ever quarreled with husband/family member over not completing household work because of water shortage?

Yes	
No	

36. Have you failed to participate in church/funeral/wedding/meeting because you had to collect water?

Yes	
No	

37. Have you got angry because of water shortage in the house?

Yes	
No	

38. Have you ever been worried because of water shortage in the house?

Yes	
No	

39. Have you experienced shame because of poor hygiene as a result of water shortage in the house?

Yes	
No	

40. How did the water shortage make you feel ashamed?

I sent children to school unbathed	
At appearing unclean to others	
Couldn't clean the house	
Couldn't offer guests drinking water	
Couldn't wash hands after coming from the toilet	
Other	

If you answered other, please specify _____

41. Have you ever been raped while going to or collecting water from the source?

Yes	
No	

42. Have you suffered from verbal assault while collecting water from the source?

Yes	
No	

43. Have you suffered from physical assault due to water shortage?

Yes	
No	

44. How did you suffer from physical assault due to water shortage?

My husband/family member hit me when I couldn't cook because of lack of water	
My husband/family member hit me when I couldn't get water for them to bath	
I fought with people while queuing at the water source	
Other	

45. If you collect water, do you feel safe?

Yes	
No	

If no, please specify why _____

Appendix F: Proof of editing

Appendix G: Turnit in report