



**LINKAGE BETWEEN WATER SHORTAGE, SANITATION AND HYGIENE
PRACTICES AMONG THE COMMUNITY OF NYARUGUNGA SECTOR, KIGALI
CITY**

By: UMULISA Olive

Supervisors: Ass. Prof. NTAKIRUTIMANA Théoneste

Mr. KORUKIRE Noël (PhD Candidate)

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DECLARATION

I, **UMULISA Olive**, hereby declare that this research entitled “**Linkage between water shortage, sanitation and hygiene practices among the community of Nyarugunga Sector**” is my original work and has not been submitted for a degree award in this or any other university. It is submitted to the College of Medicine and Health Sciences in partial fulfillment of the academic requirements for the award of Master of Public Health, University of Rwanda.

UMULISA Olive

Signature.....

Date

Approved for submission by

SUPERVISOR:

Ass. Prof. NTAKIRUTIMANA Théoneste

Signature.....

Date

DEDICATION

This research project is dedicated to my beloved husband Thaddee MUKEZABATWARE for his support and encouragement and our children Ange-Victoire, Ange Bien-Aimée, Frank and Shany also for their encouragement.

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I express my gratitude to Almighty God for his mercy, strengths, and protection granted me during this research project and my studies.

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ABSTRACT

Background: The Republic of Rwanda has made efforts to supply water to the community in the whole country but people living in Kigali, the capital city, still experience water shortage. This study aimed to determine the linkage between water shortage, sanitation and hygiene practices among the community of Nyarugunga Sector.

Methodology: A cross-sectional study design was conducted using both qualitative and quantitative methods. The sample size was 182 households and participants were selected by simple random sampling. Purposive sampling was used for the selection of key informants and focus group discussion participants.

Results: The results revealed that 96.7% of the surveyed households experience water shortage in their premises and 30.5% of households fetch water from swamps when the main water source is not functioning. The study further shows that people whose piped water from WASAC is present less than 1 time per week are 15 times more likely to suffer from water related diseases compared to those who have water at least once per week (OR=14.9, 95% CI:1.9-114.7, p=0.001). Households which don't always have clean water at the place for hand washing are almost 10 times more likely to suffer from some water related diseases than those who always have water at the place of hand washing (OR=9.97, 95% CI:2.9-33.7, p<0.001). People who skip washing hands when water is not available are 7 times more likely to suffer from some water related diseases than people who wash hands regularly (OR= 7.5, 95% CI: 3.7-15.1, p<0.0001). The factors contributing to water shortage in Nyarugunga Sector are increased water demand, few water points, weather patterns, pipelines damage, and insufficiency of water infrastructure. The main strategy that must be taken into consideration to address water shortage is the increase of the water supply in Nyarugunga Sector.

Conclusion: From a public health perspective, this study revealed that the majority of respondents (96.7%) experience water shortage in their households. The increase of water supply is needed so as to reduce the risk of water related diseases and to promote good health.

LIST OF ACRONYMS AND ABBREVIATIONS

MDGs: Millennium Development Goals

WASH: Water, Sanitation and Hygiene

WHO: World Health Organization

UN: United Nations

HIV: Human Immunodeficiency Virus

AIDS: Acquired Immune Deficiency Syndrome

RDHS: Rwanda Demographic and Health Survey

EDPRS: Economic Development and Poverty Reduction Strategy

SDGs: Sustainable Development Goals

WASAC: Water and Sanitation Corporation

SODIS: Solar Disinfection

EICV: Integrated Household Living Conditions Survey

SPSS: Statistical Package for the Social Sciences

FGD: Focus Group Discussion

H.C: Health Center

USAID: United States Agency for International Development

TABLE OF CONTENTS

DECLARATION	ii
DEDICATION	iii
ACKNOWLEDGMENTS	iv
ABSTRACT	v
LIST OF ACRONYMS AND ABBREVIATIONS	vi
TABLE OF CONTENTS	vii
LIST OF TABLES	xi
LIST OF FIGURES	xii
CHAPTER I: INTRODUCTION	1
I.1 Definition of key concepts	1
1.2 Background	1
1.3 Problem statement	5
1.4 Research objectives	7
General objective	7
1.5 Research questions	7
1.6 Significance of the study	7
I.7 Subdivision of the study.....	8
CHAPTER II. LITERATURE REVIEW	9
2.1 Climate change and the human rights to water and sanitation	9
2.1.1 The rights to water and sanitation.....	9
2.1.2 Climate change impacts on enjoyment of the rights to water and sanitation	10
2.2 Link between water and other aspects of life	12
2.2.1 Health.....	12

2.2.2 Agriculture and economic growth	12
2.2.3 Education	13
2.2.4 Conflict	13
2.2.5 Gender	13
2.2.6 The link between water, sanitation and the environment	13
2.2.7 Sanitation and hygiene.....	14
2.3 Causes of water shortage in the City of Kigali.....	14
2.4 Water-related diseases.....	15
2.5 Conceptual framework	16
2.6 Water contamination	17
2.6.1 Chemical contaminants.....	17
2.6.2 Biological contaminants	18
2.6.3 Physical contaminants	18
2.6.4 Roofwater harvesting.....	18
2.7 Water treatment systems	19
2.7.1 Storage/pre-settlement	19
2.7.2 Coagulation, flocculation, settlement and sedimentation.....	19
2.7.3 Slow sand filtration.....	19
2.7.4 Rapid sand filtration	20
2.7.5 Solar disinfection.....	20
2.7.6 Chemical disinfection.....	21
2.7.7 Boiling	21
2.7.8 Desalination/evaporation	21
CHAPTER III. METHODOLOGY	22
3.1 Study setting.....	22

3.2 Study design	22
3.3 Study population	22
3.3.1 Inclusion criteria	23
3.3.2 Exclusion criteria.....	23
3.4 Sample size and sampling techniques	23
3.5 Data collection method and procedure.....	24
3.6 Data analysis	25
3.7 Ethical consideration.....	25
CHAPTER IV: RESEARCH FINDINGS, DATA ANALYSIS AND INTERPRETATION	26
4.1 Social Demographic Characteristics of respondents.....	26
4.2 The accessibility of water in the community of Nyarugunga Sector	28
4.2.1 The main source of drinking water for the members of the household.....	28
4.2.2 The perception of Nyarugunga community on access to water.....	29
4.2.3 The time spent on water collection and the distance travelled to fetch water	30
4.2.4 The availability of water in the household	32
4.2.5 The Daily consumption of water	33
4.3 The effects of water shortage on sanitation and hygiene practices among the community of Nyarugunga Sector.....	34
4.3.1 Availability of sanitation facilities	34
4.3.2 Cleanliness of sanitation facility.....	35
4.3.3 Effects of water shortage on hygiene practices	36
4.4 The factors contributing to water shortage in Nyarugunga Sector.....	43
4.5 Strategies to cope with water shortage in Nyarugunga Sector.....	44
CHAPTER V: DISCUSSION	45
CHAPTER VI: CONCLUSION AND RECOMMENDATIONS.....	48

6.1 Conclusion.....	48
6.2 Recommendations	48
APPENDICES	54
Appendix I: Informed consent for participants	55
Appendix II: Questionnaire on “Linkage between water shortage, Sanitation and Hygiene practices among the community of Nyarugunga Sector, Kigali City”	61
Appendix III: Interview guides with key informants	76
Appendix IV: Consent forms for key informants.....	80

LIST OF TABLES

Table 1: Main source of drinking water.....	28
Table 2: Perception of Nyarugunga community on access to water shortage	29
Table 3: Availability of water in the households connected to WASAC pipeline	32
Table 4: Availability of sanitation facility	34
Table 5: Cleanliness of sanitation facility.....	35
Table 6: Hygiene status during water shortage in the household	37
Table 7: Diseases caused by poor hygiene due to water shortage	39
Table 8: Experience of poor hygiene related diseases in the last 6 months preceding the survey	40
Table 9: Association between hygiene related behaviors and suffering from water related diseases	42

LIST OF FIGURES

Figure 1: Concept framework	16
Figure 2: Marital status, gender, occupation and education level.....	26
Figure 3: Household size and age distribution of respondents	27
Figure 4: Waiting time and distance travelled to get water	31
Figure 5: Daily consumption of water	33
Figure 6: Presence of hand washing facility	36
Figure 7: Water for menstrual hygiene management.....	38

CHAPTER I: INTRODUCTION

I.1 Definition of key concepts

Hygiene is the exercise of keeping oneself and one's environs clean, particularly in order to avoid sickness or the spread of ailments that can be prevented(1).

Sanitation refers to actions that are essential for improving and protecting the health and wellbeing of individuals. It is any system that encourages proper discarding of human and animal wastes, proper usage of toilet facilities and the avoidance of open space defecation(1).

Water shortage refers to a situation where the water available in an area is not enough to meet the need present. It thus becomes necessary to institute measures to conserve water so as to make the situation easier(2).

Community refers to a group of persons living in the same area who share basic values, organization and interests(3).

1.2 Background

In 2015, it was estimated that 663 million people all over the world were still using unimproved drinking water sources, including wells and springs that were not protected, as well as surface water. Nearly half of these people lived in sub-Saharan Africa, while one-fifth was in South Asia(4). Significant differences existed among and within nations. About 90% or more of people across Latin America and the Caribbean, Northern Africa and much of Asia were able to access clean drinking water, while an average of only 61% of people in sub-Saharan Africa did(5). Of this latter group, particular sections of the population had extensive access to clean drinking water(5).

Only 32% of the rural population had access to piped water where they lived in comparison to 79% of those living in urban areas; and eight out of ten who had no access to any type of improved drinking water lived in rural areas(6). More than 90% of the richest 20% of people living in urban areas across 35 countries in sub-Saharan Africa, used water sources that have been improved and over 60% had piped water where they lived. Among the poorest 20% of the rural population, however, piped water did not exist(5).

Should this situation remain, where the human right of access to adequate sanitation and safe water supply is not given to the poor, the health of a large number of children around the world will not get better in a way that can be maintained(6). Where there is a deficiency in sanitation drinking-water is highly likely to get contaminated by microbes. Contamination of drinking-water by fecal matter can lead to diseases such as cholera, typhoid fever, paratyphoid fever, salmonellosis, shigellosis, giardiasis, hepatitis and poliomyelitis. Lack of access to these basic services, creates a situation whereby people, especially children, are not able to live in dignity and good health(6).

Lack of adequate water supply and proper sanitation are linked to the incidence of diarrheal diseases, intestinal parasites and environmental enteropathy, and to malnutrition in children(7). It has been shown that water, sanitation and hygiene (WASH) can affect a child's nutritional status through diarrheal diseases intestinal parasites and environmental enteropathy(7). Lack of adequate water, sanitation and hygiene services also affects the nutritional status through increased workload as mothers walk long distances in search of water and hence have less time for child care. In addition, diarrheal diseases and intestinal parasites cause decreased food intake, impaired nutrient absorption and direct nutrient losses leading to malnutrition. Malnutrition makes the body's defenses weaker leaving children more susceptible to illness(7).

Research has shown that even a comparatively mild invasion of parasites can reduce a child's total energy by 10% while at the same time negatively affecting digestion and absorption. An unhygienic surroundings brought about by insufficient water supply also contributes to malnutrition by making work difficult for children's immune systems. A situation is created whereby nutrients that would in different circumstances support growth have now to back the immune response(7).

Infants and young children suffer the most from the failure throughout the world to avail safe drinking water and sanitation services to poor people(8). Diarrheal diseases from easily avoidable causes take the lives of about 5000 young children worldwide every day. This figure can be greatly reduced through the provision of sufficient and better quality of drinking water and basic sanitation. Simple, inexpensive household water treatment can save even more lives. Between 2000 and 2003 some 769 000 children under the age of 5 years died every year from diarrheal diseases in Sub-Saharan Africa alone(8).

Diarrheal diseases that can be prevented kill 1.4 million children every year. Among diseases related to water, hygiene and sanitation ordinary diarrhea is the biggest accounting for 43% of deaths with Sub-Saharan Africa and South Asia taking the largest share of these(9).

According to the World Health Organization (WHO) about 6.3% of all deaths are caused by insufficient access to safe drinking water, proper sanitation facilities and hygiene practices as well as water management practices that lessen the spread of water-borne illnesses(5).

The United Nations (U.N.) estimates that more than 14,000 people die every day as a result of water-borne illnesses. Most of these deaths are caused by a number of infections. They include 2 billion cases of intestinal worms, 5 million cases each of trachoma and lymphatic filariasis, 1.4 million cases of child diarrhea and half a million from malaria. Children are particularly vulnerable to contaminated water and poor sanitation. Children below the age of 14 are twice as likely to die or become disabled as a result of exposure to these. It is estimated that some 5,000 children die every day from water- and sanitation-related diseases that can be prevented. Of these, 90% die before the age of five(5).

Inability to access to safe drinking water places a huge burden on women in particular. It is estimated, for example, that in Ghana each woman devotes 700 hours a year to fetching water. The fact that the role of fetching water and looking after sick children is played by women, creates a situation whereby the time required to get water stops more girls than boys from attending school. This adds to already existing gender inequalities in opportunity(10).

Lack of access to safe drinking water places the health of women at greater risk than is the case with their male counterparts. Added to the hazards of drinking unsafe drinking water, these women are likely to suffer as a consequence of carrying loads of up to 23 kilograms on the head, hip or back as they collect water. The threat of sexual attack is also an ever present risk for many women and girls as they leave their villages in search of water(10).

In South Africa, 30% of child deaths occur as a result of poor water and sanitation conditions. In addition to health problems, people, particularly women and children, give up their social time to look for water in situations where it is unavailable in or near their premises. Scarcity of water can lead to malnutrition and this can be very hazardous to children and people living with HIV and AIDS(11).

Kenya is also at present faced with water scarcity and the attendant struggle to supply clean water to its population. The country depends heavily on water resources not just for drinking but also for agriculture, livestock and fishing. For a long time, scarcity of water resources has continued to hold back development in sectors such as agriculture, energy, manufacturing and tourism(12).

There is at present a decline in available freshwater that has been caused by various factors. These include the uneven distribution of water resources, degradation of catchment areas, pollution of water, changing of climate and increasing demand for water as a result of increase in human and livestock populations. The available freshwater resource per capita in the country stands at less than 647 m³, which is much lower than the recommended 1000 m³ per capita per year recommended as the ideal by UN(12).

In much of Tanzania, the tasks of collecting water, cooking, cleaning and caring for children and the sick are carried out mostly by women. In the drier areas, women sometimes walk for up to five hours to fetch one bucket of water. Some 8% of rural Tanzanian households fetch water from a source over six kilometers away from their households. In pastoral societies, women have been observed sitting for most of the day before they can get water. Schoolgirls lose school hours or miss school altogether when they have to fetch water. Time saved by women when relieved from having to walk for long distances to fetch water can be used for other activities, such as childcare, farming or engaging in other income generating activities(13).

Further to this, pastoralists, particularly the women and children among them, walk long distances to fetch water. During the dry season, they cover distances between five and 15 kilometers to get water. This restricts the amount of water they can collect per day. Very few sources are improved. In most cases cattle and human beings have to use the same dirty, muddy water from a dam or pond(13).

In Uganda water resources are estimated at 66 km³ /year corresponding to about 2800 m³ /person/year. The distribution of water resources is, however, not even, which creates management challenges.

Some areas such as north-eastern Uganda have less water resources compared to others such as the central region that have plenty. This explains the reason for increasing incidents of conflicts related to water use in the water scarce parts of the country, particularly in the cattle corridor. Here, pastoralists move from place to place in search of water and vegetation posing not just a security threat but also a major health risk as diseases are transferred from one area to another in this process(14).

The most recent Rwanda Demographic and Health Survey (RDHS) (2014/15) states that 91 per cent of the urban households and 69 per cent of rural households use an improved drinking-water source. Of the remaining 31 per cent of rural households have no access to an improved drinking-water source, 16 per cent fetch their water from unprotected springs, 13 per cent from surface water and 2 per cent from an unprotected well. Some 55 per cent of households in rural areas spend 30 minutes or longer, round trip, to obtain drinking water(7).

Water supply and sanitation services were therefore identified by the Economic Development and Poverty Reduction Strategy (EDPRS II) and prioritized as a very important service that will contribute greatly to the attainment of the growth that Rwanda needs. Despite the fact that access to improved water and sanitation services has been increasing continually over the past years in Rwanda, the rate of increase is still not enough to achieve both SDGs as well as the more stringent targets set in the Vision 2020(15).

1.3 Problem statement

Water is a limited resource that is indispensable for supporting life on earth, to human existence and to the natural functions of plants and animals. Water is also essential for human and socio-economic development as it is required in industrial processing, generation of energy, transport, agriculture, tourism and other commercial activities. Water is thus a resource that must be prudently harnessed, optimally used, controlled and managed properly in order to get the greatest possible benefit from it while lessening its potentially negative effects(16).

Access to safe water is a fundamental human right that is recognized in international legal instruments. These provide for adequate, safe, satisfactory, physically accessible and affordable water for personal and domestic uses. A sufficient supply of safe water is necessary to prevent death from dehydration, to reduce the risk of water-related illnesses and to take care of drinking, cooking, and personal and domestic hygienic needs(17).

The World Health Organization (WHO) recommends that water sources be within one kilometer of the home and that the time taken to fetch it should not exceed 30 minutes(17). People must have water throughout the day and water pipelines must exist in each community and function well in order to supply water to the people. For the ones who don't have water in their premises they could use the public water points which must be located not far from their houses. People should not have to make long journeys to fetch water.

Literature indicates that it is becoming more widely accepted that insufficient access to water sanitation and hygiene exposes vulnerable groups, especially women and girls directly to violence. The perceived threat of such violence may cause psychosocial stress, which adds to other causes of such stress, for instance the perceived threat of harassment, or that of not being able to meet basic needs(18).

Despite the fact that the government of Rwanda has made much effort to supply water to whole country and cities in particular, people living in Kigali, the capital city, have had to constantly live with an insufficient water supply and water outages. The daily average water supply time is 8 hours, which is very brief. As a result, the City of Kigali has been forced to engage in constant water rationing and temporarily stop water supply to some areas (19). Due to this water shortage people may face challenges such as inability to satisfy different domestic needs. This situation has particularly negative effects on hygiene and sanitation practices which jeopardizes the health of people.

The issue of water shortage affects different Sectors of City of Kigali and Nyarugunga Sector is one among them. Queues of people are often to be found at the public tap near Nyarugunga H.C and at Murindi borehole, waiting for water. People struggle with the problem of water shortage regularly. The effects of water shortage on the life of Nyarugunga community are not documented. This could handicap the planning and interventions that could be made to address this issue. This study, therefore, aims at exploring the linkage between water shortage, sanitation and hygiene practices among the community of Nyarugunga Sector in order to provide information to policy makers, Water and Sanitation Corporation (WASAC) and other partners to establish appropriate interventions for the water shortage in Nyarugunga Sector.

1.4 Research objectives

General objective

Determine the linkage between water shortage, sanitation and hygiene practices among the community of Nyarugunga Sector.

Specific objective

- Determine the accessibility of water in the community of Nyarugunga Sector.
- Determine the effects of water shortage on sanitation and hygiene practices among the community of Nyarugunga Sector.
- Identify the factors contributing to water shortage in the community of Nyarugunga Sector.
- Identify strategies to cope with water shortage in the community of Nyarugunga Sector.

1.5 Research questions

- How accessible is the water supplied to the community of Nyarugunga Sector?
- What are the effects of water shortage on sanitation and hygiene practices among the community of Nyarugunga Sector?
- What factors contribute to water shortage in the community of Nyarugunga Sector?
- What strategies can be used to cope with the water shortage in the community of Nyarugunga Sector?

1.6 Significance of the study

This study seeks to explore the linkage between water shortage, sanitation and hygiene practices among the community of Nyarugunga Sector.

The ability to access safe drinking water and sanitation is critical, not just for people's health and comfort, but also for reduction of poverty and economic progress(20).

This study will help to determine the constraints encountered by the residents of Nyarugunga Sector as relates to their ability to access safe and clean water.

This will help provide WASAC and other development stakeholders, the information required for alleviating water shortage and facilitate the selection of interventions related to water supply to be implemented in Nyarugunga Sector.

I.7 Subdivision of the study

This research report is divided into six main chapters. The first chapter is the introduction that includes definitions of key concepts, background of the study, problem statement, research objectives, research questions, significance of the study and subdivision of the study.

The second chapter is the literature review and is followed by the third chapter which covers methodology. The fourth chapter focuses on research findings, analysis and interpretation, the fifth is the discussion and the sixth the conclusion and recommendations of the research.

CHAPTER II. LITERATURE REVIEW

2.1 Climate change and the human rights to water and sanitation

Climate change is an additional challenge in a situation whereby close to a billion people do not have access to safe drinking water, and 2.5 billion to sanitation. This situation is without a doubt a human rights concern(21).

Climate continues to have an impact on people's rights to water and sanitation in various ways. These include by causing changes in rainfall patterns, floods and droughts, and temperature extremes that cause water shortages, pollution of drinking water and an increase in the spread of disease. Water shortage may also bring about increases in the cost of water and sanitation provision. Those likely to be affected the most are the poor, who are among the most exposed(21).

Climate change places at great risk the obtainment of the rights to water and sanitation. It has great effects on hydrological systems, affecting as it does both the quantity and quality of water and the safety of sanitation facilities. It has been predicted that climate change will result in consequences such as run-off from melting snow and ice, changes in rainfall, drought, flooding, and the breakdown of water and sanitation systems from extreme weather events. These are all likely to make a contribution to insufficient access to clean water(22).

2.1.1 The rights to water and sanitation

The right to water is defined as the right of every person to adequate, safe, satisfactory, physically available and reasonably priced water for personal and domestic use. Importantly, the right to water is restricted to water for personal and domestic use and no other water uses(21).

Water is essential to human life. Lack of drinkable water directly brings about human suffering through disease, sickness, and death. The human rights to water and sanitation are indisputable. They were universally recognized by the United Nations General Assembly in 2010. These rights mean that every person, has the right to water and sanitation that is safe, socially and culturally satisfactory, physically available, inexpensive, and that is provided without bias (22).

Sanitation in human rights terms is a system for the collection, conveyance, treatment and discarding or reuse of human excreta and related hygiene. Everyone has the right to physical and economical access to sanitation which is safe, clean, secure, socially and culturally satisfactory, and that provides privacy and ensures dignity. These rights must be granted without fail and without bias(21).

The recognition in July 2010 by the United Nations General Assembly of the human rights to quality water and sanitation has been seen globally as a key milestone. The assembly acknowledged the right of every individual to have access to adequate water for personal and domestic uses that is, between 50 and 100 liters of water per person per day. This must be safe, satisfactory and inexpensive, i.e. that water costs should not go beyond 3 per cent of household income. It must also be, physically available, i.e. that the water source has to be within one kilometer from the home and the time taken to fetch it should not go beyond 30 minutes. (23).

2.1.2 Climate change impacts on enjoyment of the rights to water and sanitation

2.1.2.1 Availability: Water scarcity and increased competition for water

A rise in water scarcity will bring about an increase in competition between domestic, agricultural and industrial water use. Water availability of less than 1000 cubic meters per capita per year is widely used as an indicator for water insufficiency. This is a threshold below which it is supposed that the demand for water in a society can no longer be provided for. Household water use, however, makes up for only a small part of total water use, i.e. less than 10 % in the global average. Agriculture and industry on the other hand use much more water, averaging 70 % and 20 % respectively globally(21).

Assuming that a quantity of about 100 liters per capita per day is needed to satisfy the right to water, this comes to 36,500 liters per capita per year or 36.5 m³. Although climate change places greater strain on water resources and adds to the struggle over inadequate resources, does not make the achievement of human rights related to water and sanitation unattainable. It is rather a matter of making decisions that ensure that basic needs are prioritized(21).

2.1.2.2 Quality: Problems through pollution and changing groundwater levels

Climate change will have negative effects on the quality of water. This will happen through rising water temperatures, higher or lower groundwater levels, floods and droughts which will turn increase the risk of more chemical substances, micro-organisms, and radiological dangers in drinking water. Floods and droughts will bring about many types of water pollution such as groundwater becoming more saline as well as the intrusion of sediments, pathogens, organic carbon, and pesticides. All these will have a negative effect on people's health of the population(21). Flooding may cause harm to sanitation systems while extreme weather conditions may result in the weakening of infrastructure. This will further negatively affect the quality of drinking water. Sanitation systems that require water may also become blocked where the water available is too little(21).

2.1.2.3 Accessibility: Impact on water and sanitation infrastructure

Floods and drought cause the weakening of water and sanitation infrastructure. Where precipitation increases over a long period of time, groundwater levels may rise, resulting in a reduction of the effectiveness of natural purification processes. This will increase the risk of infectious disease and of contact with toxic chemicals. Some of the secondary effects of climate change on water supply and sanitation that could potentially occur include energy interruptions which would in turn lead to an increase in the undependability of piped water and sewerage services(21). Ensuring the ability of water and sanitation infrastructure to withstand climate change is, therefore, an important measure in adapting to climate change. Water and sanitation infrastructure needs to be made more hardy, whether faced with the threat of flooding or drought. This calls for new ways of doing things as well as creative technologies, adequate investments in infrastructure, capacity growth, and transfer of technology(21).

2.1.2.4 Affordability: Rising costs

Climate change also has an indirect effect on the ability of people to afford water and sanitation services. Rising demand for water and competition over the same bring about an increase in water prices. In addition, when water and sanitation infrastructure is damaged, then renovation required will also result in making services more costly. It is important that states see to it that these additional costs do not make access to water and sanitation too expensive. Targeted subsidies, for, example, can go some way in addressing this(21).

2.1.2.5 Acceptability: How to cope with change?

Concerns about the acceptability of adaptation strategies will come up as water distribution patterns change in a big way. Putting up water points or sanitation amenities which are culturally unacceptable should be avoided or addressed. Such amenities may be unacceptable as a result of their location, the technology chosen or due to some other consideration. Making sure that the concerned community is involved in the design and implementation of what is planned is critical in this regard(21).

2.2 Link between water and other aspects of life

2.2.1 Health

A number of diseases that include diarrhea and some neglected tropical diseases are acquired through contact with water and soil that are infested with bacteria. These diseases cause many deaths and illnesses every year. Mosquitoes, flies and other vectors also breed in water. Good sewerage and drainage systems can help ensure the removal of breeding grounds. Water can be treated to eliminate bacteria (5).

2.2.2 Agriculture and economic growth

More than 1 billion people annually are afflicted by parasitic worms which cause a number of ailments. These include stunting, malnutrition, and anemia. Worm eggs are left in the soil when infected humans defecate on the ground. Humans can be infected in a number of ways. These include worms penetrating the skin, through ingestion when people fail to wash their hands properly before eating and after touching contaminated soil and when people eat crops grown in contaminated soil(5). In an effort to get away from infested fields, farmers may move to places where the quality of soil is lower and where there is less access to water and may unintentionally carry the worm eggs with them. Greater access to improved farming technology, for instance to irrigation, mechanized farming tools and fertilizers and better sanitation facilities can help stop the transference of these diseases(5).

Water scarcity also hinders development projects such as the construction of roads, bridges, complexes etc. Adequate water is vital for the existence of these projects. According to Blignaut and Van Heerden water shortages may hamper economic growth(24).

2.2.3 Education

The task of fetching water often falls on women and children. As a result children often miss school while collecting. In addition to this, girls without access to sanitation facilities during their menses may drop out of school. Being able to access clean water can reduce the amount of time children spend fetching water and ensure more time for education. At the same time, provision of sanitation facilities in schools can contribute to school completion rates among girls(5).

2.2.4 Conflict

An increasing number of conflicts are made worse by inadequate access to water. Rising demand and greater unpredictability in rainfall can aggravate tensions(5).Water conflicts may come about when communities are sharing this very inadequate resource(24).

2.2.5 Gender

Traditionally, women are tasked with making water available in the household, ensuring hygiene and providing health care. They are therefore most negatively impacted when water supplies are inadequate and sanitation is poor(7). This notwithstanding, women are generally not well represented in decision-making, in the running of water and sanitation infrastructure as well as in training and educational activities. Improvements in water supply are known to have a positive effect on women, by bettering living conditions, reducing the amount of work they do, for instance in fetching water and caring for the sick, bettering hygienic conditions in schools and possibly enhancing women's involvement and empowerment (7).

2.2.6 The link between water, sanitation and the environment

Water and sanitation are issues that are central to the environment. They are also crucial to development. Taking care of water supplies so they do not become depleted nor contaminated, and ensuring good sanitation, are key to the well-being of communities and their environment (25).

Whole communities can be negatively affected by a failure to provide adequate water and sanitation. When one person's sanitation is poor, another person's food or water is likely to be contaminated as a result. Piped systems, if not properly managed, can bring about problems such as pollution in rivers, lakes and seas. This can damage wildlife habitats and add to human health problems. Where extreme water and sanitation shortages exist, a number of serious public health threats are likely to result(25).

2.2.7 Sanitation and hygiene

Water, sanitation and hygiene are vital for health, wellbeing and livelihoods. Greater access and better services bring about higher levels of achievement in schools and better economic output (26).

Water and sanitation are essential to public health. Once access to clean water and adequate sanitation facilities are secured for all people, regardless of differences in their living conditions, the occurrence of all kinds of diseases will be significantly reduced. As an example, bettering access to safe water sources and better sanitation practices can reduce the incidence of trachoma by 27% and that of ascariasis by 29%. The incidence of hook worm can be reduced by 4% (27). To improve public health, access to water that is suitable for drinking must go hand in hand with sanitation works and efforts to raise awareness about hygiene among populations(28).

2.3 Causes of water shortage in the City of Kigali

The City of Kigali suffers perennial water shortages. There are three causes that have been identified as the possible source of this problem. The first of these is the fact that recent expansion of the city has not been planned in such a way as to provide for a viable water supply plan. The topography of the city is also such that those living in valleys get the little water available in contrast to those living on the top of hills. Secondly, the water network that is currently in place is rather old, or damaged. Thirdly, the flow of water in Nyabarongo and Nyabugogo rivers or other small rivers has reduced due to environmental concerns that include the destruction of forests and soil erosion(29).

2.4 Water-related diseases

High concentrations of pathogens in water supply pose a danger to human health. Diverse microorganisms can live in water for long periods of time; some of these directly expose the health of the consumers of such water to risks. Other pathogens are associated with insects that live part of their life in water, and many water-related diseases are caused by these pathogens(30).

Water-borne diseases are associated with traditional causes of waterborne outbreaks. In sub-Saharan Africa, for instance, cholera and typhoid are spread through contaminated water(28).

Water-borne diseases result from the drinking of water contaminated by human or animal feces or urine that contains pathogenic bacteria or viruses. Such pathogens include those that cause typhoid, cholera, amoebic and bacillary dysentery and other diarrheal diseases(30).

Water-washed diseases occur as a result of too little water being used for domestic hygiene. The most important factor here is quantity and not quality. As a result skin diseases and ophthalmic diseases are likely to occur but also diarrhea(28).

These type of diseases occur as a result of poor personal hygiene and skin or eye contact with contaminated water, and they include scabies and trachoma(30).

Water-based diseases are caused by pathogens transmitted by organisms living in water. These diseases are spread during the incubation phase of these organisms through contact, for instance taking baths or washing clothes or drinking of contaminated water. In sub-Saharan Africa, the two main water-based diseases are schistosomiasis and guinea worm disease(28).

Water-related insect vector diseases are those transmitted by insects that develop or feed in water. They include such as malaria and dengue and river blindness(28).

Other water-related diseases caused by insect vectors, include, filariasis, onchocerciasis, trypanosomiasis and yellow fever(30).

2.5 Conceptual framework

The conceptual framework shows the relationship between the independent variables (water shortage), the dependent variables (hygiene and sanitation) and intervening variables of the study (government policies and stakeholders interventions).

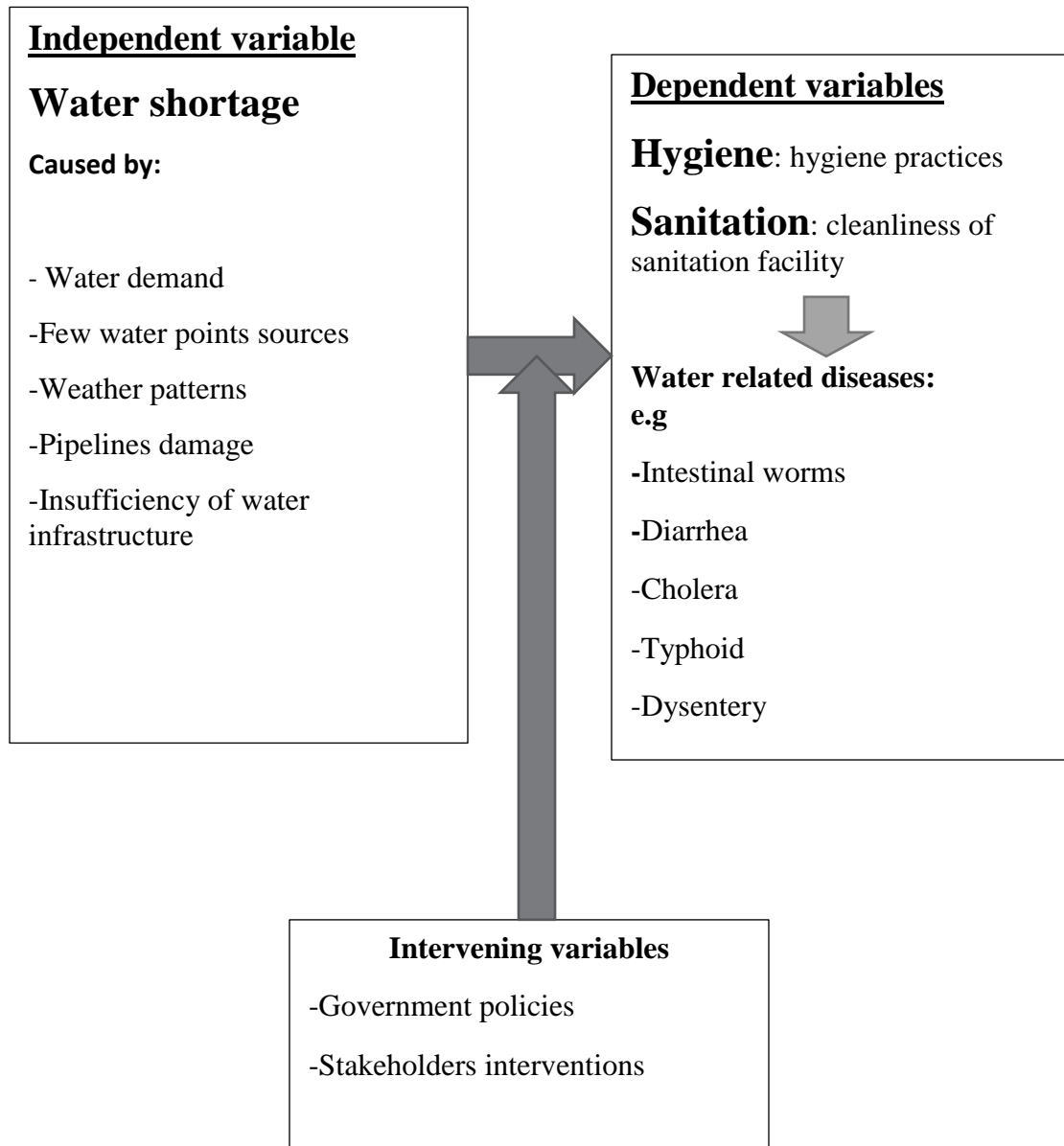


Figure 1: Concept framework

2.6 Water contamination

The following agents can cause the contamination of water:

- *Pathogens*: illness-causing organisms. These include bacteria, viruses and amoebas, and the eggs and larvae of parasitic worms.
- *Harmful chemicals resulting* from human activities. These include pesticides, fertilizers and industrial wastes.
- *Chemicals and minerals from the natural environment*. These include arsenic, fluorides and common salt. Some non-harmful pollutants may impact the taste, color, smell or temperature of water, which may result in its being unacceptable to the community(31).

Water from surface sources is often polluted by microbes. While groundwater is usually safer, it can also be contaminated by harmful chemicals from the natural environment or from human activities. Rainwater captured by system where water is harvested from a roof or through the use of small catchment dams is comparatively safe, so long as the first water when the rainy season begins is allowed to flow to waste. When treating water the amount that needs to be treated should also be assessed. To estimate this, one use the assumption that each person needs a minimum of 20–50 liters of water daily for cooking, drinking, laundry and personal hygiene(31).

2.6.1 Chemical contaminants

High concentrations of manganese and iron in ground water create an unpleasant taste and turn the water a brownish color. This color can be passed to clothes and food. These minerals are often removed by aeration which makes them insoluble leaving in a fine, dark sediment. Aeration can be done by causing the water to fall from a place high up into a storage tank(32).

Another class of chemical contaminants, nitrites and nitrates has been linked with methemoglobinemia. This is a condition where a larger proportion of hemoglobin is caused to turn into methemoglobin resulting in less oxygen being carried in the blood. This results in cyanosis, particularly in bottle-fed infants of 3-6 months old. In such children, the condition is also known as ‘blue baby syndrome’. Nitrates can seep into groundwater as a result of the use of fertilizers or from wastewater. Water that has been contaminated with nitrites and nitrates is difficult to treat. It is, therefore, better to prevent the contamination in the first place(32).

Fluoride is found in all natural water. High levels, however can lead to spotting of teeth and skeletal fluorosis. Coagulation and the use of activated alumina can eliminate excess fluoride. Activated alumina is a highly porous material made from aluminum hydroxide that acts as an absorbent. It may be available and affordable for communities living in developing countries. Arsenic also occurs naturally when water filters through a certain type of rock. High concentrations of arsenic can lead to skin injuries and a higher risk of cancer(32).

2.6.2 Biological contaminants

Pathogens that are borne through fecal matter can be transmitted by water. These diseases can, however, also be passed through any fecal-oral route. Parasitic worms such as flatworms, roundworms and guinea worms can pass their eggs to humans through the drinking of contaminated water and cause infection. Any water supply must be completely free from them. Legionella, a type of, bacteria are commonly found in hot and warm water pipes. Infection happens when one inhales mist or spray containing the bacteria. The resulting illness is known as Legionnaires' disease and can lead to pneumonia related to respiratory function(32).

2.6.3 Physical contaminants

Physical contaminants comprise particles and suspended solids. They are mostly a problem when people use surface water. The magnitude of the problem changes from one season to the next and is compounded by heavy rains and greater speed of the water flows. Drinking murky water is hazardous as solids in water can make available the perfect setting for bacteria to breed. This being the case, it is critical that suspended solids are always removed before disinfection of water(32).

2.6.4 Roofwater harvesting

Even though there are fewer sources of pollution for roofwater, care must be taken to avoid contamination from the roof, gutters, piping system and storage facilities. Water collected from rooftops needs to be filtered and boiled before it is consumed(32).

Iron sheets themselves pose no risk. There is, however a risk of contamination by bacteria if there are animal feces on the roof. These can be from birds, lizards, etc.

Roofs need to be kept as clean as possible. In addition, a first flush system should be employed to wash away the first few millimeters of rain when the rainy season commences(32).

2.7 Water treatment systems

Systems for treating water are put up for two reasons. The first is to eliminate things that can cause illness and those that create nuisances. The basic aim of water treatment is to protect public health. The broader objective, however, is to provide clean water that is safe to drink, pleasing in appearance, taste and smell, and profitable to produce(33).

2.7.1 Storage/pre-settlement

Storage of water for only one day can ensure removal of some bacteria. Water should, however, be stored for 48 hours to remove cercaria (snail larvae). The longer the time that water is stored, the more suspended solids and pathogens settle at the base of the container. After sedimentation, the water at the top can then be utilized(31).

2.7.2 Coagulation, flocculation, settlement and sedimentation

Coagulation takes place when a liquid coagulant, such as aluminum sulfate, is added to water to draw suspended particles. Gentle stirring of the water then causes the particles to come together and form larger particles, a process known as flocculation. The bigger particles formed can then be removed by settlement, sedimentation, or filtration. The amount of coagulant required is determined by what the contaminating chemical compounds and solids are(31).

Diverse chemicals can be used as coagulants. The most commonly used include aluminum sulfate, lime, ferric chloride and polyelectrolytes(34).

Sedimentation is any technique for treating water that uses the settling of suspended particles, which include microbes, to eliminate them from water(35).

2.7.3 Slow sand filtration

In this method, water seeps slowly downwards at a steady rate through a bed of fine sand. The water must not be too murky or the filter will get clogged.

Harmful microorganisms are removed naturally in the top layer of sand where a biological film is left behind. A possible problem, however, arises from the fact that some homes may not use this technology well and the water may hence remain contaminated(31).

2.7.4 Rapid sand filtration

The sand used in this method is coarser than that in slow sand filtration and hence water flows at a higher rate. The method is used to eliminate solids dispersed in water and works well after the water has been cleared through coagulation/flocculation. A biological film does not build up, hence the water still needs to be sterilized. Trapped debris from up flow sand filters is easier to remove than is the case with filters in which the water flows downwards(31).

2.7.5 Solar disinfection

The sun's ultraviolet radiation can destroy most harmful microorganisms. When water temperature is increased the radiation is even more effective. In tropical areas, exposing polluted water to sun for five hours, with the midpoint around midday will destroy most harmful microorganisms. This can be easily done by exposing the half-blackened clear glass/plastic bottles of water to the sun. Shaking the bottle before irradiation increases the effectiveness of the treatment that can be increased by shaking the bottle before exposing it to the sun. The water must be clear for this treatment to work well(31).

The use of solar disinfection, commonly known as SODIS, is now becoming widespread. The technique is quite straightforward. The available water, which is in this case contaminated, is put into ordinary transparent bottles. The bottles are then put under direct sunshine for at least six hours, after which time the harmful microorganisms will have been killed. Users will usually have two sets bottles. One set is left out for a full day while they drink from the other set which had been subjected to solar disinfection the previous day. The majority of those who use the SODIS technique use plastic bottles because they are light, durable and easy to get but glass bottles and even plastic bags will also produce the same result. Container that have a volume of up to about three liters are appropriate for SODIS(36).

2.7.6 Chemical disinfection

The use of chlorine is the most common method of sterilizing drinking-water. Chlorine can be used in the form of liquids such as bleach, powders such as bleaching powder or purpose-made tablets. Iodine can also be used for the same purpose. The success of chlorination depends on the quality of untreated water, which may change from one season to the next. This makes the decision on the right amount of chlorine to use a rather tricky one(31,37)

2.7.7 Boiling

Boiling water will kill most harmful microorganisms, and many are destroyed at lower temperatures, for instance, 70 °C. This method can be costly, however, because of the fuel required to boil the water(31). It is also the most common means of treating water in households. When done properly, boiling is also one of the most effective methods, destroying or deactivating all classes of harmful microorganisms that live in water. These include protozoan cysts that are not always destroyed by chemical disinfection and viruses that are too tiny to be removed through microfiltration(38).

2.7.8 Desalination/evaporation

Desalination through the process of distillation produces water that has no chemical salts. The method can be used at household level but can be costly due to the capital investment required and because fuel is used to heat the water. The amount of water produced through the method is also low(31).

Desalination is the process used to remove salt and other dissolved minerals from water. Some desalination processes may also remove other water pollutants such as dissolved metals, bacteria, and organics(39).

CHAPTER III. METHODOLOGY

3.1 Study setting

The study was conducted in Nyarugunga Sector, Kicukiro District in City of Kigali. Nyarugunga Sector is composed of 3 cells: Kamashashi, Nonko and Rwimbogo, and 28 villages. Its population is 40,057 and counts 20,960 males and 19,097 females. The density, i.e. inhabitants/km² is 2,622. Nyarugunga Sector is among the most populated sectors of Kicukiro District(40).

Concerning the educational characteristics of the population, the distribution of the school-age population of Nyarugunga for pre-school age (3-6 years) is 64.1% for currently attending, 1.6% for no longer attending and 34.3% for never attended. For primary school age (7-12 years) is 98.8% for currently attending, 0.3% for no longer attending and 1.7% for never attended. For secondary school age (13-18 years) is 72.7% for currently attending, 25.4% for no longer attending and 1.9% for never attended (40).

The prevalence of disabilities is 2.7%. Nyarugunga Sector counts 951 persons with disabilities and among them, 593 are males and 358 are females. The total elderly population aged 60 years and above is 737 and includes 268 males and 469 females(40).

Concerning water and sanitation of private households, for the main source of water 98.2% use an improved source of water while 1.2% of households use an unimproved source of water. For the main type of toilet facility, 8.5% use flush toilet/WC system, 44.2% use private pit latrines, 44.1% use shared pit latrines and 0.1% use other types(40).

3.2 Study design

A cross-sectional study design was used to determine the linkage between water shortage, sanitation and hygiene practices among the Nyarugunga sector residents. The study was both qualitative and quantitative.

3.3 Study population

The study population was composed of households located in Nyarugunga Sector of Kicukiro District and females' - heads of households were the target respondents.

3.3.1 Inclusion criteria

All females'- heads of households in the selected area of Nyarugunga Sector willing to participate in the study were surveyed. The participants were aged from 18 and above.

3.3.2 Exclusion criteria

Those who didn't want to participate were excluded from the study. In addition, those who had mental health illness were excluded from the study.

3.4 Sample size and sampling techniques

Participants were selected by using simple random sampling from 8 villages of Nyarugunga Sector. The simple random sampling was used to obtain a sample from a sampling frame of all the households in each study area/village. The sample size was determined in such a way to get sufficiently precise estimates for the main indicators of interest for this study. The sample size of the number of households using the reference indicator of the prevalence of population whose main water source is improved in Kicukiro District is 75.6 % according to the EICV4(41).

The following parameters were taken into consideration in calculating the minimum sample size for the households to be visited: Confidence level of 95%; relative standard error: 5% as marginal error, a design effect of 1.5.

The sample size calculated was 166, and by adjusting it to include the non-response rate of 10 %, the final total sample size was revised to 182 households in the study. The following formula was used to derive a minimum sample size required:

$$n = \frac{\text{Deff}^2 p (1-p)}{e^2}$$

$$n = 1.5^2 \cdot \frac{0.756(1-0.756)}{0.05^2} = 166 \text{ households.}$$

n= net sample size

P = prevalence of 0.756

Z: Confidence coefficient of 1.96

(Confidence levels of 95%)

Deff: 1.5 (Design effect)

Margin error =5 %

Non Response: 10 %

Therefore: Total n will be = 182

Purposive sampling was used for the selection of key informants and focus group discussion participants. The key informants were the Manager of WASAC/Kanombe Branch, the Executive Secretary of Nyarugunga Sector and the Head of Nyarugunga Health Center. In addition, two focus groups composed of 8 community members each were considered.

3.5 Data collection method and procedure

A questionnaire was used to collect quantitative data while qualitative data were collected by using focus group discussions and key informant interviews. Questions were constructed in such a way that the researcher could easily get information on the linkage between water shortage, sanitation and hygiene practices within Nyarugunga community. The researcher adapted tools used in similar studies to the context of this study and also to the context of Rwanda. These studies included the following: *The impact of water shortage to human development, a case study of Kigali city*(2), *The water scarcity and economic productivity of women: A case study of Kibauni Division, Machakos County in Kenya*(12) and *The effects of water scarcity on rural livelihoods: A case study of Borakalalo, village in Lehurutshe (North West province) in South Africa*(11).

Enumerators were recruited and trained to facilitate data collection. The key informant interviews with the Manager of WASAC/Kanombe Branch, the Executive Secretary of Nyarugunga Sector and the Head of Nyarugunga Health Center were conducted. In addition, two focus groups with community members were also conducted.

The study started by a pilot study for pre-testing the questionnaire tool. Pre-testing is a technique of checking to see whether questions are understood by the persons who are likely to respond to them and elicit the intended responses. Pretesting can help to reduce sampling error and increase questionnaire response rates. It can be a valuable method to assess whether a new measure works in the field as planned(42). The pilot study was carried out in one cell of Nyarugunga sector selected by simple random sampling. After the pilot study the questionnaire tool was adjusted and improved accordingly.

3.6 Data analysis

The researcher used some computer software applications like Statistical Package for the Social Sciences (SPSS) and MS Excel. Statistics were used to analyze the quantitative data obtained from the field. For the qualitative data, the information obtained from key informant interviews and FGD were analyzed and interpreted according to the objectives of the research.

3.7 Ethical consideration

An ethical approval was obtained from IRB of College of Medicine and Health Sciences. The approval was then presented to Nyarugunga Sector local authorities. Permission to carry out study in the sector catchment area was been granted to the researcher. Obtained permission was presented to the village leaders to help the researcher reach participants. All study participants were informed about the purpose of the study. Participation was voluntary and confidentiality was assured to them. In addition, participants were informed about their rights of participation and withdrawal from the study at any time, and that there would be no punishment in the latter case. The participants were also informed that there would be no compensation for participation in this study. An informed consent form was signed before starting the study.

Limitation of this study

- This study was conducted in one sector of the City of Kigali; results from this study cannot be assigned to the whole City of Kigali. Further studies could be done in other sectors to give a broader picture of the situation of water shortage in the whole City of Kigali.
- The study focused on the situation of water shortage only in the households of Nyarugunga Sector. There is a need to consider other components of the community such as schools, hospitals, restaurants, hotels etc.

CHAPTER IV: RESEARCH FINDINGS, DATA ANALYSIS AND INTERPRETATION

4.1 Social Demographic Characteristics of respondents

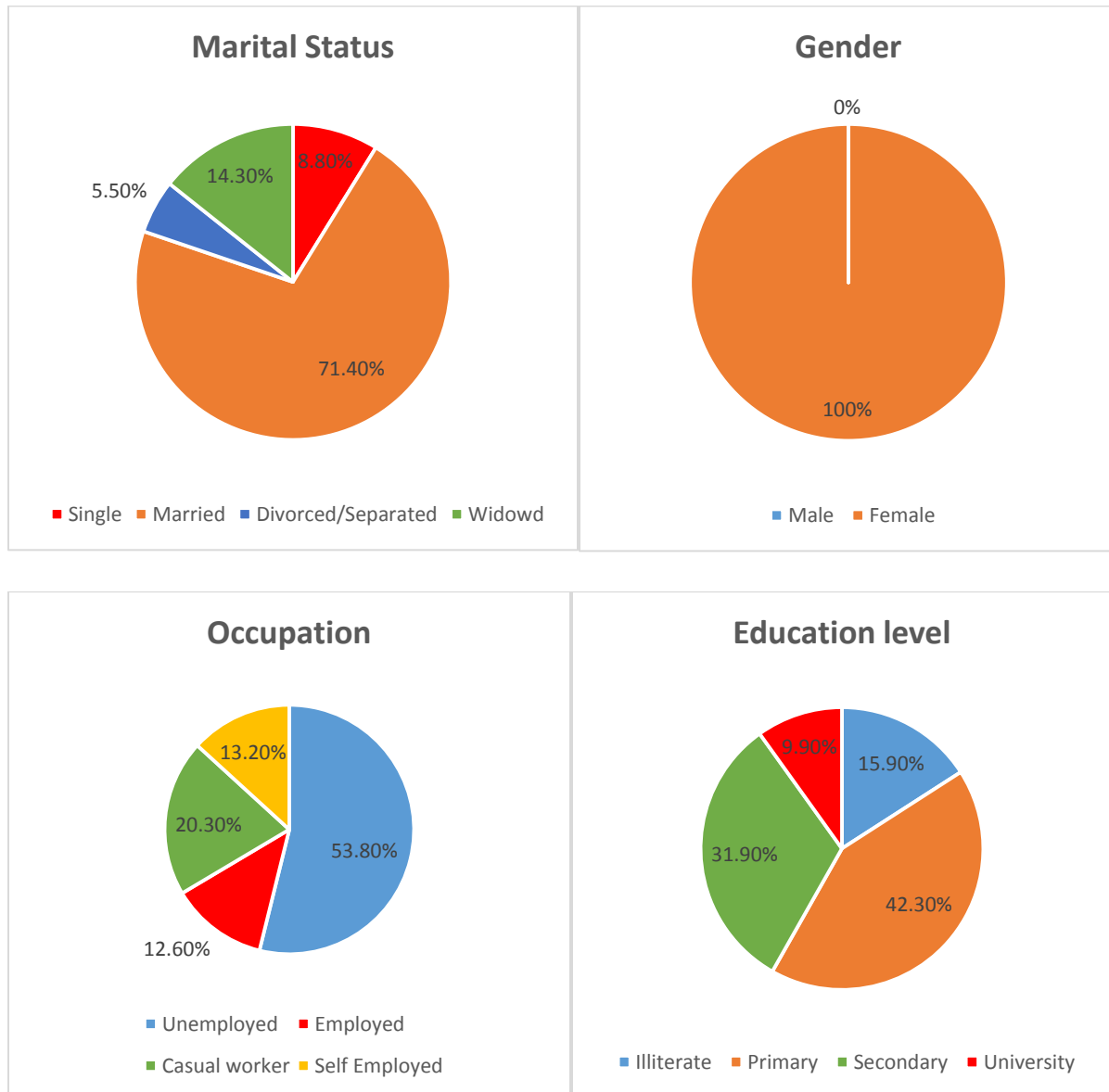


Figure 2: Marital status, gender, occupation and education level

a. Marital status

The majority of respondents (71.4%) in this research were married, 14.3% were widowed, 8.8% were divorced/separated and 5.5% were single.

b. Gender

All respondents in this research were female, because when there is a shortage of water in the home, women, rather than men, are usually responsible to search for and fetch water and struggle with that problem.

c. Occupation

The results of the research showed that the majority of respondents (53.8%) were unemployed, 20.3% were casual worker, 13.2% were self-employed while 12.6% were employed.

d. Education level

According to the findings, 42.3%, mentioned that they had attained education up to primary level, 31.9% up to secondary school level, 15.9% had never attended school while 9.9% had gone up to university level.

g. Household size and age distribution of respondents

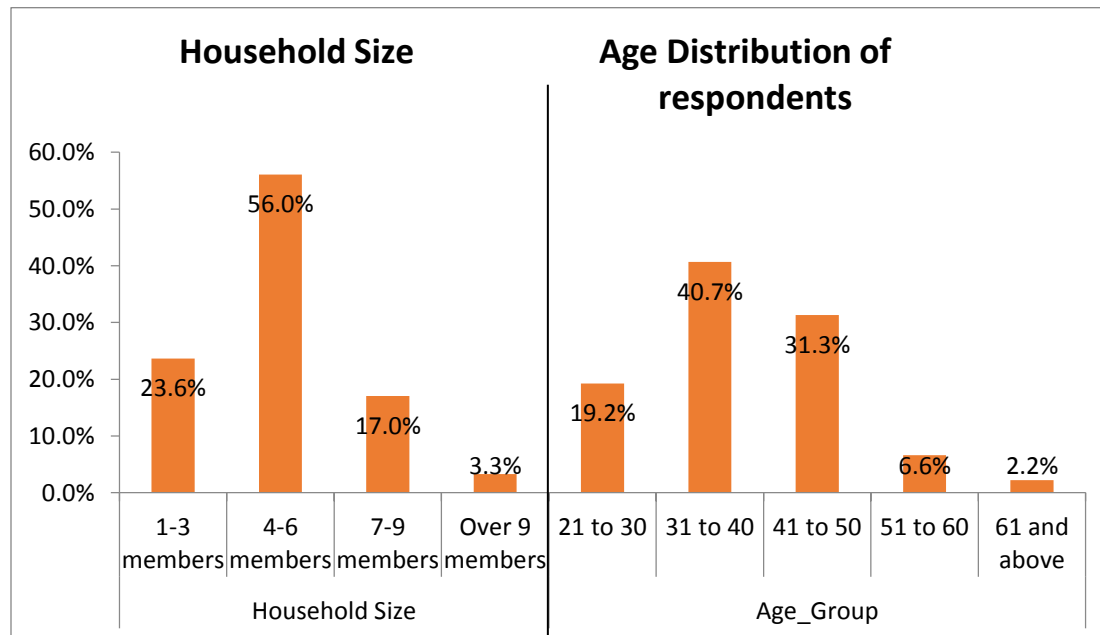


Figure 3: Household size and age distribution of respondents

The figure shows that the majority of respondents (56%) lived in households of 4 to 6 members and a significant percentage (40.7%) of respondents was between 31 and 40 years old while 31.3% were between 41 and 50 years old.

4.2 The accessibility of water in the community of Nyarugunga Sector

4.2.1 The main source of drinking water for the members of the household

The study focused on the main sources of drinking water used by household members.

Table 1: Main source of drinking water

Variables	Source of water	Frequency	Percentage
Main water source of drinking water	Piped water into dwelling.	122	69.3%
	Public tap	36	20.5%
	Borehole	7	4.0%
	Rain water	0	0.0%
	Spring	0	0.0%
	Surface water e.g. lake, river	11	6.3%
	Other/Specify	0	0.0%
Functionality of water source	Yes	7	3.8%
	No	175	96.2%
Source of drinking water when the main water source is not functioning	Fetching from a public tap	49	27.7%
	Buying from water sellers	74	41.8%
	Fetching from swamps	54	30.5%

The majority of households (69.3%) indicated that their main source of drinking water was piped water into dwelling. Some 20.5% drank water from a public tap, 6.3% fetched surface water while 4% reported that their main source of drinking water was a borehole.

Concerning the functionality of water source, the results showed that 96.2 % of households confirmed that their main source of drinking was not always functional against 3.8% of households who revealed that it was functional.

When their water source was not functioning 41.8% indicated that they collected water through water sellers (these are people who fetch water and sell it using bicycles or those who own tanks in their compounds). Some 30.5% fetch water from swamps while 27.7% fetch water from

public taps. The results show that the main source of drinking water is piped water from their dwelling, but when the water source is not functioning, there are some households (30.5%) who fetch water from swamps.

4.2.2 The perception of Nyarugunga community on access to water

The study focused on the experience of water shortage by household members and how they perceive it.

Table 2: Perception of Nyarugunga community on access to water shortage

Variables	Access to water	Frequency	Percentage
Experience of water shortage in the household	Yes	176	96.7%
	No	6	3.3%
The perception of the quantity of water supplied in the area	Insufficient	176	96.7%
	Sufficient	6	3.3%
	Abundant	0	0.0%

The majority of households (96.7%) confirmed that they experience water shortage in their premises and the same portion of households (96.7%) perceives the quantity of water supplied in their area as insufficient.

The water shortage in the area of Nyarugunga Sector was mentioned by key informants and the participants in focus group discussion.

“Nyarugunga sector is supplied water by Karengu water factory located in Rwamagana District and supplies water also to other sectors of Masaka, Rusororo, Ndera, Remera and Kimironko. The Karengu water factory was created many years ago and its functioning is still at the same capacity from its creation. Since then there was no intervention made to extend its water production capacity, while the population it serves has significantly increased. This is an existing reality in Nyarugunga Sector. WASAC Branch Manager

“During our home visit in Nyarugunga community, it’s not uncommon to find some households with poor hygiene.” (the person in charge of community health at Nyarugunga Health Center).

“The problem of water shortage exists in many villages of Nyarugunga Sector: the community doesn’t get water as they wish and on time.” (the person in charge of community health and sanitation at Nyarugunga Sector).

“In average of 6 out (of) 7 days per week the water is not available and the community members who have no means to buy water resort to fetching surface water from swamps.” (FGD participant).

“The problem of water shortage is serious in our area. Sometimes people get food items to cook but fail to get water for cooking.” (FGD participant).

For managing the water shortage, the participants in FGD indicated that they do their best to collect water by either buying water from bicycle riders (*abanyonzi*) or from storage tank owners or else by fetching water from swamps or from a public tap.

The results showed that the problem of water shortage is critical; some measures must be taken in order to alleviate it.

4.2.3 The time spent on water collection and the distance travelled to fetch water

The study focused on the time spent on water collection and the distance travelled to reach the nearest water point.

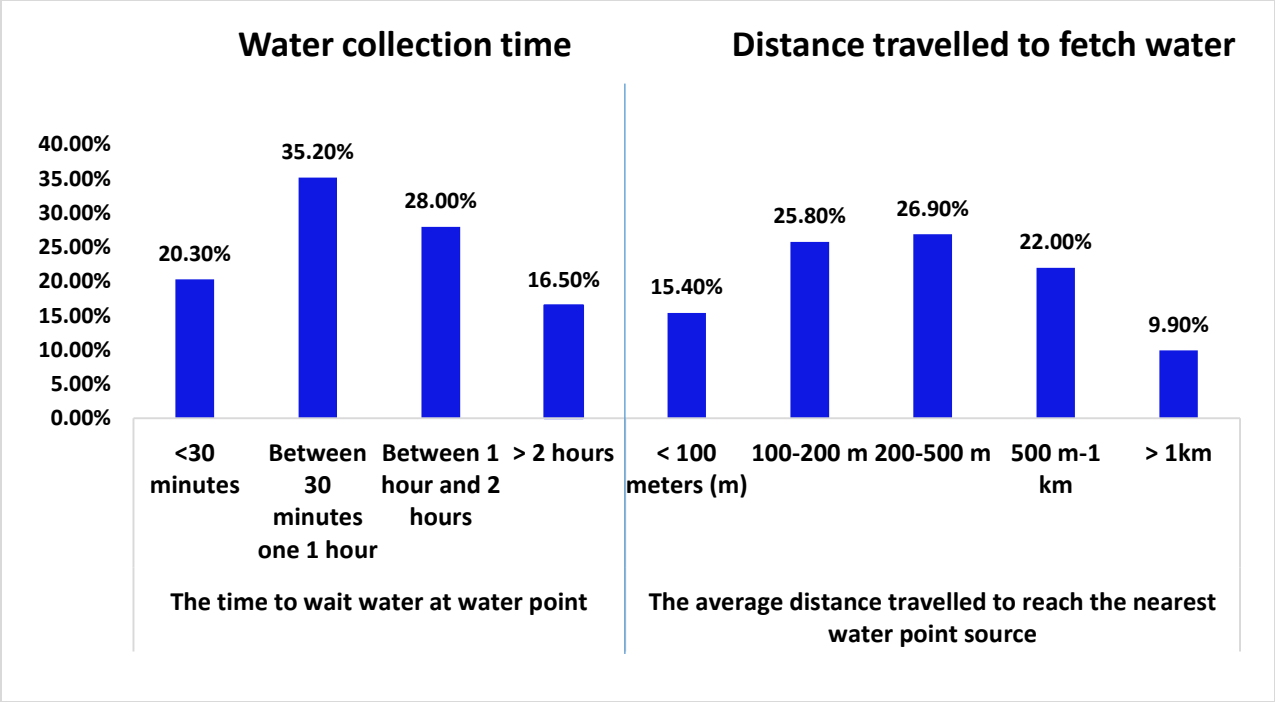


Figure 4: Waiting time and distance travelled to get water

The results of the study showed that 35.2% of respondents spent between 30 minutes and one hour waiting for water at a water point, 28% spent between one hour and two hours, while 20.3% spent less than 30 minutes and 16.50% over two hours.

As concerns the distance travelled to reach the nearest water point, 26.90% of respondents reported having to travel between 200 and 500 meters, 25.80% between 100 and 200 meters and 22% between 500 meters and one kilometer, while 15.40% travelled less than 100 meters and only 9.9% more than one kilometer. The results show that the majority of respondents spent more than 30 minutes in waiting for water at a water point, and that a significant percentage had to travel a distance longer than 200 meters. The time waited at water point and the distance travelled to fetch water both have an impact on the accessibility of water.

4.2.4 The availability of water in the household

The study focused on the availability of water in the households.

Table 3: Availability of water in the households connected to WASAC pipeline

Variables	Time	Frequency	Percentage
Usually water availability	Every day	6	4.9%
	Twice or three times per week	30	24.4%
	Once a week	47	38.2%
	Once in two weeks	29	23.6%
	Beyond two weeks	11	8.9%
In six months preceding the survey	Every day	5	4.1%
	Twice or three times per week	22	17.9%
	Once a week	54	43.9%
	Once in two weeks	34	27.6%
	Beyond two weeks	8	6.5%
On the day of survey	Yes	39	31.7%
	No	84	68.3%
Numbers of hours the water is available in the tap	The whole day	34	27.6%
	1-3 hours	57	46.3%
	4-6 hours	25	20.3%
	7-12 hours	7	5.7%

Table 3 shows that 38.2% of the households get water once a week, 24.4% twice or three times per week, 23.6% once in two weeks, and 8.9% once in a period longer than two weeks. Only 4.9% get water every day.

Some 43.9% confirmed that they had gotten water once a week during the previous six months while only 4.1% had gotten water every day. During the research time, only 31.7% reported that water was flowing in their taps.

Regarding water availability in taps, the majority of households (46.3%) reported that when water was released, it was available in the tap for one to three hours while only 27.6% reported accessing water for the whole day when it was released. In terms of water availability per week,

38.2% of the respondents reported accessing water once a week in their household for one to three hours at that time while 43.9% reported accessing it for the same length of time during the previous six months.

4.2.5 The Daily consumption of water

The study focused on the daily consumption of water.

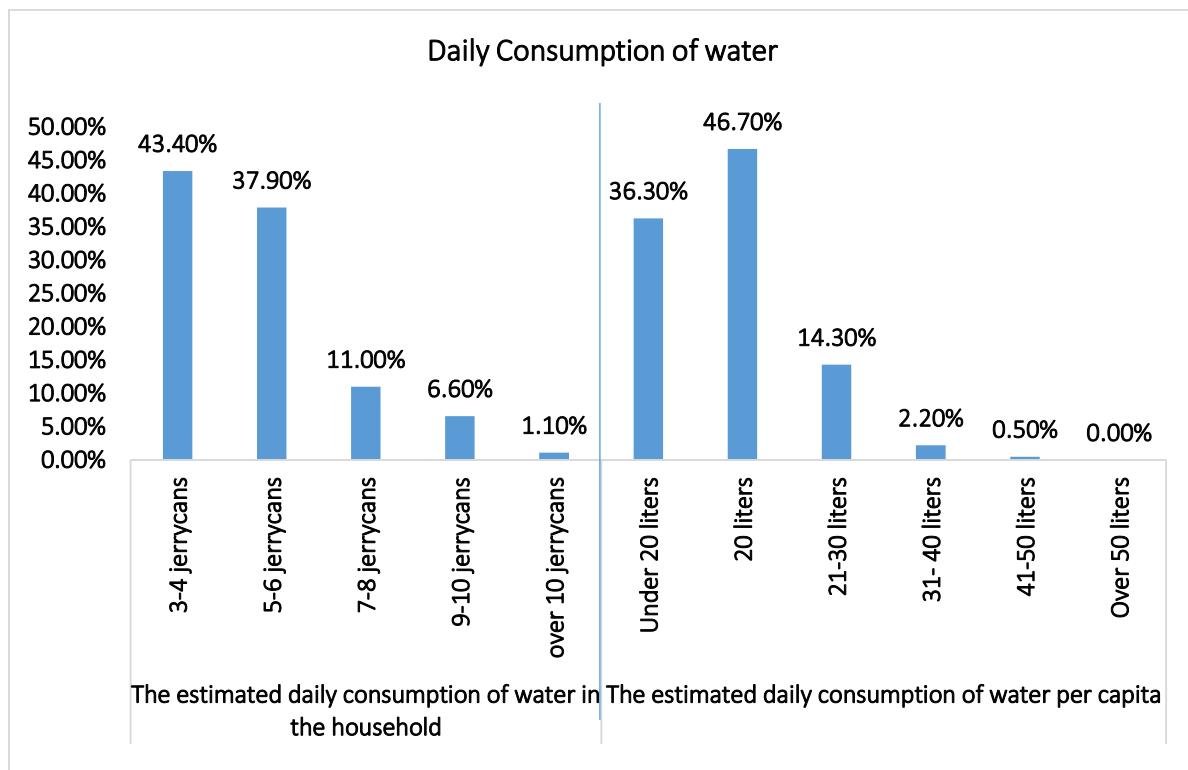


Figure 5: Daily consumption of water

The respondents estimated daily consumption of water. 43.4% indicated they used 3 to 4 jerry cans per day while 37.9% reported that they used 5 to 6 jerry cans.

As concerned daily consumption of water per capita, 46.70% indicated that they used 20 liters per capita while 36.3% reported that they used less than 20 liters per capita. The results show that there were some respondents (36.3%) who used less than 20 liters per day per capita. This is under the minimum requirement of 20 liters per day and per capita required by WHO(43).

4.3 The effects of water shortage on sanitation and hygiene practices among the community of Nyarugunga Sector

4.3.1 Availability of sanitation facilities

The study focused on ownership of sanitation facilities.

Table 4: Availability of sanitation facility

Variables	Availability of latrine	Frequency	Percentage
Functionality of toilet/latrine	Yes	182	100.0%
	No	0	0.0%
Pit latrine with slab	Yes	159	87.4%
	No	23	12.6%
Pit latrine covered with wooden poles	Yes	10	5.5%
	No	172	94.5%
Flush or pour flush toilet	Yes	30	15.9%
	No	152	84.1%
Sharing the toilet facility with other households	Yes	88	48.4%
	No	94	51.6%
Getting enough water to flush the flush toilet	Yes	17	56.7%
	No	13	43.3%

The respondents in the study indicated that they all had a functional latrine. Some 87.4% used a pit latrine with a slab, 15.9% a flush toilet and 5.5% a pit latrine covered with wooden poles. Among the respondents 48.4% shared the toilet facility with other households. For people who had a flush toilet 43.3% did not get enough water to flush it. The results showed that the majority of respondents (87.4%) used pit latrines with a slab. To keep pit latrines with a slab and flush toilets clean, enough water is required at household level. When there is insufficient water, this results in a hygiene problem in the household. It is the same case for a shared toilet facility.

When a toilet is used by many people, there is need to clean it regularly, and the water shortage leads to uncleanness and its consequences.

4.3.2 Cleanliness of sanitation facility

The study focused on the cleanliness of the sanitation facility, whether the respondents have any problems in keeping the toilet clean and the hindrances and effects of maintaining the cleanliness of the toilet.

Table 5: Cleanliness of sanitation facility

Variables	Cleanliness of latrine	Frequency	Percentage
Having problem of keeping the toilet clean	Yes	132	72.5%
	No	50	27.5%
Unavailability of water for cleaning	Yes	132	98.5%
	No	2	1.5%
Unavailability of cleaning materials	Yes	13	9.7%
	No	121	90.3%
Too many users	Yes	34	25.4%
	No	100	74.6%
Other users don't know how to use it	Yes	18	13.4%
	No	116	86.6%
All	Yes	12	9.0%
	No	122	91.0%
Presence of bad odor in the toilet	Yes	176	96.7%
	No	6	3.3%
Presence of flies in the toilet	Yes	171	94.0%
	No	11	6.0%
Presence of feces and urine on the slab of the toilet	Yes	161	88.5%
	No	21	11.5%
People could be infected with diseases due to poor hygiene	Yes	162	89.0%
	No	20	11.0%
All	Yes	159	87.4%
	No	23	12.6%

The majority of households (72.5%) confirmed that they had a problem in keeping their toilet clean due to unavailability of water and this was confirmed by 98.5% of households.

As consequences 96.7% revealed that there was bad odor in the toilet, 94% that there were flies in the toilet, 89.9% that people could be infected with diseases due to poor hygiene, 88.5% that feces and urine were present on the slab of the toilet and 87.4% that all these factors were effects of water shortage for cleaning toilets. These results show that the unavailability of water for the maintenance of the cleanliness of toilets aggravates poor sanitation.

4.3.3 Effects of water shortage on hygiene practices

a. Water shortage and hand washing practice

With regard to hygiene practices, the study focused on the presence of hand washing facilities together with soap and water.

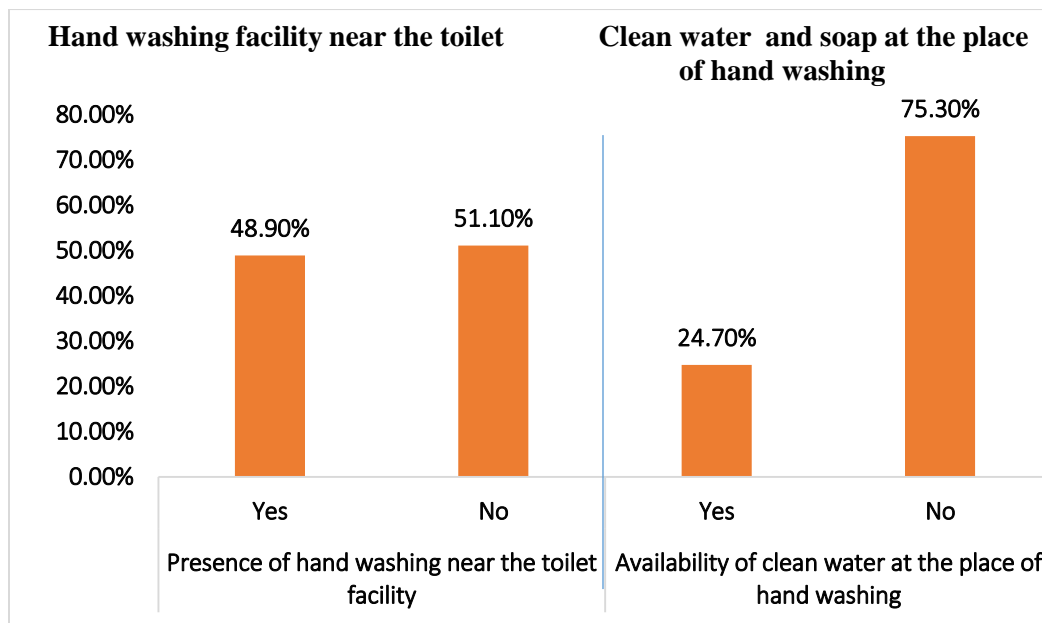


Figure 6: Presence of hand washing facility

Figure 6 shows that a significant percentage (51.1%) indicated the absence of a hand washing facility near their toilets and the majority of households (75.30%) confirmed that clean water and soap were not always available at the hand washing point. The results showed that the practice of hand washing was done by few people (48.90%) and it was not done on a regular basis due to the unavailability of water.

b. Hygiene status during water shortage in the household

The study focused on hygiene status during water shortage in the household.

Table 6: Hygiene status during water shortage in the household

Variables	Hygiene status	Frequency	Percentage
Drinking water	Yes	0	0.0%
	No	182	100.0%
Cleaning house	Yes	126	69.2%
	No	56	30.8%
Taking bath	Yes	82	45.1%
	No	100	54.9%
Hand washing	Yes	63	34.6%
	No	119	65.4%
Washing clothes	Yes	171	94.0%
	No	11	6.0%
Washing dishes	Yes	30	16.5%
	No	152	83.5%
Garden watering	Yes	178	97.8%
	No	4	2.2%
Cleaning the toilet	Yes	93	51.1%
	No	89	48.9%

The majority of respondents (97.8%) indicated that when there is water shortage in the household they skip garden watering, 94% skip washing clothes, 69.2% cleaning the house, 51.1% cleaning the toilet, 45.1% taking a bath and 34.6% hand washing. Generally, water shortage has negative effects on domestic chores and on personal hygiene.

C. Water shortage and menstrual hygiene management

The study focused on getting enough water for personal hygiene and the materials used when females are in the period of menstruation.

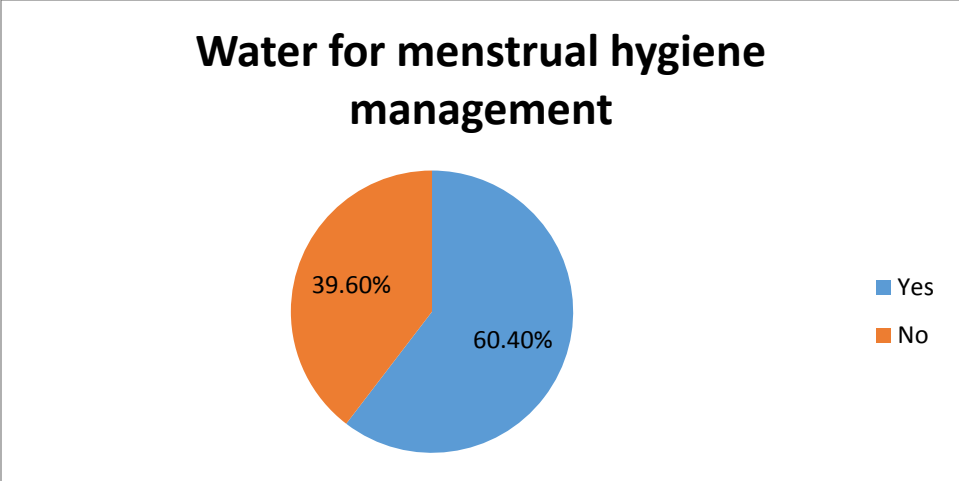


Figure 7: Water for menstrual hygiene management

Figure 7 shows that 60.40% indicated that they got enough water for personal hygiene and the materials used during the menstruation periods against 39.60% of respondents who confirmed that they didn't get enough water for menstrual hygiene management. Even though the majority of respondents (60.40%) got enough water for menstrual hygiene management, there was a significant percentage (39.60%) of respondents who did not. This could be a problem for their health. The consequences of poor menstrual hygiene management include the possibility of catching urogenital infections such as reproductive tract and urinary tract infections(44).

d. The diseases caused by poor hygiene due to water shortage

Even though water shortage has negative effects on sanitation and hygiene practices, it has also effect on health due to poor sanitation and poor hygiene. There are some water related diseases which could occur. The study focused on some diseases caused by poor hygiene due to water shortage.

Table 7: Diseases caused by poor hygiene due to water shortage

Variables	Water related diseases	Frequency	Percentage
Existence of some diseases caused by poor hygiene due to water shortage	Yes	182	100.0%
	No	0	0.0%
Intestinal worms	Yes	180	98.9%
	No	2	1.1%
Diarrhea	Yes	176	96.7%
	No	6	3.3%
Cholera	Yes	170	93.4%
	No	12	6.6%
Dysentery	Yes	171	94.0%
	No	11	6.0%
Typhoid	Yes	172	94.5%
	No	10	5.5%
All	Yes	171	94.0%
	No	11	6.0%

The table 7 shows that all respondents (100%) thought that there were some diseases caused by poor hygiene due to water shortage. Some 98.9% mentioned intestinal worms, 96.7% diarrhea, 94.5% typhoid, 94% dysentery, 93.4% cholera and 94% all those diseases as being caused by poor hygiene due to water shortage.

The key informants and the participants in FGD were asked about the effects of water shortage on hygiene and sanitation practices at household level. They mentioned that people practiced poor hygiene. The main activities such as cooking, bathing, washing, hand washing and house cleaning were poorly done and sometimes there were some activities which were skipped due to water shortage. There was also an effect on health: people suffered from diseases due to poor hygiene as mentioned by one participant in FGD, who mentioned: *“Some children suffer from diarrhea due to poor water quality or insufficient quantity of water.”* An insufficient supply of

water negatively affects health both directly and indirectly. It also makes good sanitation and hygiene difficult(45).

The key informants were also asked what they have done so far to mitigate the effect of water shortage in Nyarugunga Sector. The Kanombe WASAC Manager indicated that they practiced the system of water rationing to help ensure that people got water at least once a week. For Nyarugunga Sector, they had found partners such as **Isuku Iwacu** and **Gikuriro USAID** that help communities to improve health and plan to facilitate them get water in the village. Also Nyarugunga Sector had sensitized the community on management of water and asked them to report damages to water pipelines to WASAC for intervention.

e. Disease experience and poor hygiene due to water shortage in the last 6 months

The study focused on some diseases caused by poor hygiene due to water shortage in the previous six months.

Table 8: Experience of poor hygiene related diseases in the last 6 months preceding the survey

Variables	Water related diseases	Frequency	Percentage
Experience of diseases caused by poor hygiene due to water shortage by household members in the last 6 months	Yes	60	33.0%
	No	122	67.0%
Intestinal worms	Yes	40	22.0%
	No	142	78.0%
Diarrhea	Yes	26	14.3%
	No	156	85.7%
Cholera	Yes	0	0.0%
	No	182	100.0%
Dysentery	Yes	0	0.0%
	No	182	100.0%
Typhoid	Yes	3	1.6%

	No	179	98.4%
I don't know	Yes	0	0.0%
	No	182	100.0%

The results of research show that only 33% of respondents indicated that some members of their households had suffered from some diseases caused by poor hygiene due to water shortage in previous six months. The main diseases suffered by some members were intestinal worms as indicated by 22% and diarrhea as indicated by 14.3%.

As to whether there were some cases of water related diseases received at Nyarugunga H.C., it was shown that the main disease that occurred during the six months from July 2018 to December 2018 was diarrhea, and its prevalence in children under the age of five treated at the health center in that period was 25%.

Table 9: Association between hygiene related behaviors and suffering from water related diseases

Hygiene behaviors practices	OR	95% CI	P-value
Not taking baths and not washing the materials used during menstruation	2.11	1.12-3.96	0.019
Not cleaning toilet	2.9	1.51-5.57	0.001
Not washing dishes	6.76	2.85-16.0	<0.001
No hand washing	7.5	3.79-15.17	<0.001
Not having clean water near the toilet	9.97	2.94-33.77	<0.001
No place for hand washing	1.89	1.01-3.56	0.045
Problems in keeping toilet clean	3.41	1.48-7.85	0.003
Sharing toilets with households	2.02	1.07-3.78	0.028
Missing water for a long time or Water is present <1 time per week	14.92	1.94-114.7	0.001

The study showed that people whose piped water from WASAC is present less than 1 time per week are 15 times more exposed to suffer from water related diseases when compared with those who have water at least once per week (OR=14.9, 95% CI:1.9-114.7, p=0.001). Households which don't always have clean water at the place for hand washing are almost 10 times more exposed to catching some water related diseases than those who always have water at the place of hand washing (OR=9.97, 95% CI:2.9-33.7, p<0.001). People who skip hand washing when water is not available are 7 times more exposed to suffering from some water related diseases than people who wash their hands regularly (OR= 7.5, 95% CI: 3.7-15.1, p<0.0001). People who

reported not to wash dishes when there is no water are almost 7 times more likely to suffer from water related diseases than those who do (OR=6.7, 95% CI=2.85-16.0, p<0.001).

People who reported not to clean the toilet when there is no water have a risk 3 times higher of suffering from water related diseases than those who reported to clean the toilets even when there is no running water present OR=2.9, 95% CI: 1.51-5.57, p=0.001. People who reported to share toilets with other households are 2 times more exposed to suffering from water related diseases compared to those who do not share toilets with other households (OR=2.0, 95% CI:1.0-3.7, 0.028). Households with no hand washing point at their toilet are almost 2 times more exposed to suffering from some water related diseases than those who have it (OR= 1.89, 95% CI: 1.01-3.56, p=0.047. People who have menstruation periods in absence of water are 2.1 times more exposed to suffering from water related diseases than those who do not (OR=2.1, 95% CI: 1.1-3.9, P=0.019).

4.4 The factors contributing to water shortage in Nyarugunga Sector

The key informants and the participants in FGD indicated that the factors contributing to water shortage were increased water demand, few water points, weather patterns, pipelines damage and insufficiency of water infrastructure.

“The water infrastructures are not adapted on the increased population and the water pipelines used are fewer and smaller.....If there were sufficient pipelines the water of Nyabarongo River could be captured and treated for serving people..... also sometimes water pipelines are damaged and this contribute to water shortage but when we are informed the reparation is promptly done” (Kanombe WASAC Manager).

“There is increased water demand and water is not sufficient.” (FGD participant)

“During the dry season the problem of water shortage is very complicated. In some places we have to fetch water meanwhile the water flow is reduced hence people make queues to the functional water sources which are few. (FGD participant).

4.5 Strategies to cope with water shortage in Nyarugunga Sector

The results of the research showed the following strategies that could be adopted to cope with water shortage in Nyarugunga Sector:

“WASAC as an institution responsible for supplying water is planning to increase water pipelines in order to be able to capture, treat and distribute water from Nyabarongo River and this is hoped to increase the water quantity supplied in Nyarugunga Sector and other areas in City of Kigali. This will be made possible through the fund of the African Development Bank to the Rwanda government for increasing water supply.” (Kanombe WASAC Manager)

“Developing some natural water sources found in different areas of Nyarugunga Sector, establishing some kiosks for water in Nyarugunga Sector and maintaining the communication with WASAC about increasing the water production supplied in Nyarugunga Sector would be the way to go.” (The person in charge of community health and sanitation at Nyarugunga Sector).

“To treat the dirty/swamp water before usage should be a temporary solution.” (FGD participant).

“To search for water containers, tanks if it is possible and fill them when water is available”. (FGD participant). This was also the advice given by the Kanombe WASAC Manager to Nyarugunga residents on how they could cope with water shortage.

CHAPTER V: DISCUSSION

The main objective of this study was to determine the linkage between water shortage, sanitation and hygiene practices among the community of Nyarugunga Sector. The study sought to explore the accessibility of water, the effects of water shortage on sanitation and hygiene practices and the factors contributing to water shortage in order to help the community and other stakeholders to take appropriate measures to alleviate water shortage in Nyarugunga Sector.

Study findings showed that even though the majority of households (69.3%) have piped water into their dwellings, 30.5% of the households fetch water from swamps when the main water source is not functioning. Water shortages create a situation where people may have no choice but to find negative ways to cope such as fetching from places like rivers which are often polluted. Such practices affect health and wellbeing in a negative way(25).

This study highlighted that the majority of households (96.7%) experienced water shortage in their premises; they perceived water as insufficient. This was confirmed by the WASAC Branch Manager and other key informants interviewed. This finding is similar to that of the study conducted in South Africa where almost all respondents indicated that they were not accessing adequate water(11).

In addition to this, the majority of the respondents spent more than 30 minutes waiting for water at water points and a significant percentage had to travel distances longer than 200 meters to fetch water. This finding is similar to that found in the study conducted in Kigali City(2). Concerning the estimated daily consumption of water per capita, however, there was a difference with the Kigali study. The daily consumption per capita of majority of respondents was found to be 20 liters in this study whereas in that study it was found to be 60 liters per capita(2).

The study found that the frequency of water supply was not regular because most of the people accessed water only once a week. This finding was similar to that in the study conducted in South Africa(11). In addition, the study highlighted the effects of water shortage on sanitation and hygiene practices and on health in general.

There is poor sanitation and hygiene due to water shortage and as a result, people suffer from the diseases caused by this such as diarrhea, intestinal worms etc. Some domestic activities like house cleaning, washing, toilet cleaning, personal bathing and hand washing are skipped by many people in order to spare water for critical prioritized household basic needs.

The effects of water shortage were mentioned by others studies conducted in City of Kigali, Kenya and South Africa(11, 2,12). Water shortage leads to poor hygienic practices, and more risks of infections(46). It leads to a situation where certain uses of water, such as for laundry are scaled down, leading to a lowering of general hygiene levels(46).

Even though the majority of respondents (60.40%) get enough water for menstrual hygiene management there is a significant percentage (39.60%) of respondents who don't. Women and girls face challenges in managing hygiene during menstruation when the environment in which they find themselves is not supportive of this. This is particularly the case when they have challenges in accessing water, sanitation, and/or healthcare. When this happens, it can work against their ability to access certain rights such as those to education, work, and health(47).

The main diseases suffered by some members in the last six months prior to the study were intestinal worms as indicated by 22%, and diarrhea as indicated by 14.3%. The case of diarrhea was confirmed by the data given by Nyarugunga H.C. In the period of six months prior the research, the prevalence of diarrhea was 25% in children under the age of five treated at the Health Center. Diarrhea remains the most prevalent public health issue in Eastern Africa which originates from water and sanitation problems. The disease can be either water-borne or water-washed(28).

This study revealed some factors contributing to water shortage such as increased water demand, weather patterns that were mentioned by other studies conducted in City of Kigali, Kenya and South Africa(11,2,12). Other factors such as few water sources, the damage to pipelines and insufficiency of water infrastructure were, however, not mentioned by those studies.

The strategies that can be adopted to help alleviate water shortage in Nyarugunga Sector are to increase the production of water supplied in Nyarugunga Sector, use of more storage water containers and tanks when water is available, water distribution regulation (i.e. rationing), information sharing with WASAC authorities whenever pipes are damaged and pipe rehabilitation. These strategies necessitate the consistent follow up of community members, local authorities and WASAC authorities.

CHAPTER VI: CONCLUSION AND RECOMMENDATIONS

6.1 Conclusion

Water is vital for human life, whether it is used for drinking, cooking, cleaning, sanitation or agriculture(48).

This study revealed that the majority of households (96.7%) experienced water shortage in their premises. Even though the majority of households (69.3%) have piped water in their dwellings as the main source of water, there is a significant percentage (30.5%) of households which fetch water from swamps when the main water point is not functioning.

The water shortage has effects on sanitation and hygiene practices and on health in general. There is poor sanitation and poor hygiene and, as a result, community members suffer from diseases caused by poor hygiene due to water shortage. The factors contributing to water shortage are increased water demand, fewer water points, weather patterns, pipeline damage, and insufficiency of water infrastructure.

To alleviate the water shortage, sound strategies must be taken in consideration. These include increase of the water supply in Nyarugunga Sector, availability of water containers and storage tanks to be filled when water is made available, regulating the distribution of the available water, and informing WASAC whenever water pipes are damaged for prompt repair.

6.2 Recommendations

The researcher presents the following recommendations to:

WASAC

- ✓ To increase the production of water supplied in Nyarugunga Sector. Such increase is vital in ensuring an improvement in individual and home hygiene and for maintenance of the cleanliness of sanitation facilities(45).
- ✓ To rehabilitate damaged water pipes that needs intervention immediately whenever informed.

✓ To regulate the system of water rationing with equity and reduce imbalance in distribution (the study shows that there are households who get water every day or three times a week while others are either served once a week or twice a month).

Nyarugunga Sector

✓ To follow up on projects run by organizations who are seeking to supply water to the community.

✓ To sensitize the community on water management and the use of water treatment techniques, especially for those who use swamps water.

✓ To increase community awareness on sanitation and hygiene practices, especially the practice of hand washing. Hand washing is important for good health. It has been estimated that hand washing with the use of soap can reduce the risk of diarrheal diseases by 42–47%, and in the process can save a million lives a year. Hand washing has also been found to reduce the occurrence of acute respiratory infections(49,50).

✓ To drill or capture water from different places in Nyarugunga Sector where natural water sources are available.

Community members

✓ To store enough water by using containers and tanks, filling them when water is available.

✓ To develop the habit of treating water at household level.

✓ To wash hands with soap during critical times.

✓ To harvest rain water during the rainy season.

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APPENDICES

Appendix I: Informed consent for participants

INFORMED CONSENT FORM

Name of principal investigator: UMULISA Olive

Organization: University of Rwanda

Telephone number:+250787688976

This Informed Consent Form is for the females' head of households who I am inviting to participate in research on “**Linkage between water shortage, sanitation and hygiene practices among the community of Nyarugunga Sector, Kigali city**”.

This Informed Consent Form has two parts:

- Information Sheet (to share information about the research with you)
- Certificate of Consent (for signatures if you agree to take part)

Part I: Information sheet

I am UMULISA Olive, student at University of Rwanda in the program of Master's in Public Health. I am doing research on water shortage which is an issue in City of Kigali. I am going to give you information and invite you to be part of this research. It is your choice to participate in the research or not. If you find some words you don't understand, please stop me I will explain them to you.

Purpose of the research

The research aims to determine the linkage between water shortage, sanitation and hygiene practices among the community of Nyarugunga Sector in order to provide information to WASAC and other partners to manage appropriate interventions to that issue.

Participant selection

The targeted participants are the females' heads of households who are living in Nyarugunga Sector.

Voluntary participation

Your participation in this research is entirely voluntary. It is your choice whether to participate or not.

Duration

The questionnaire answering will take 20 minutes.

Reimbursement

To be part of this you will not be provided any incentive

Confidentiality

The information that we collect from this research will be kept confidential in locked draw. Only the research team will be aware of the information you will give.

Right to refuse or to withdraw

Participation in this study is voluntary, you are free to participate. If you decide not to be part of this study nothing will happen to you. Refusing to participate will not affect you. When you accept to participate, you will be free to withdraw in case you do not feel comfortable or for any other personal reason(s). If you agree to participate, you will be requested to sign the consent form which is a proof of your own decision to be part of the study.

Part II: Certificate of consent

I have read the foregoing information, or it has been read to me. I have had the opportunity to ask questions about it and any questions that I have asked have been answered to my satisfaction. I consent voluntarily to participate as a participant in this research.

Name of Participant _____

Signature of Participant _____

Date _____

Statement by the researcher/person taking consent

I confirm that the participant was given an opportunity to ask questions about the study, and all the questions asked by the participant have been answered correctly and to the best of my ability. I confirm that the individual has not been coerced into giving consent, and the consent has been given freely and voluntarily.

Name of Researcher/person taking the consent _____

Signature of Researcher /person taking the consent _____

Date _____

Who to Contact

If you have any questions, you can ask them now or later. If you wish to ask questions later, you may contact any of the following: UR/CMHS e-mail: researchcenter@ur.ac.rw

IFISHI YO KUGIRA URUHARE MU BUSHAKASHATSI

Amazina y’umushakashatsi w’ibanze: UMULISA Olive

Ikigo: Kaminuza y’u Rwanda

Telefoni: +250787688976

Iyi fishi igenewe abantu b’igitsinagore bakuriye ingo batuye mu murenge wa Nyarugunga nsaba kugira uruhare mu bushakashatsi burebana n’ **“Isano Ibura ry’Amazi rifitanye n’ibikorwa by’Isuku n’Isukura mu ngo zo mu murenge wa Nyarugunga mu mujyi wa Kigali”**.

Iyi fishi igizwe n’ibice bibiri:

- Amakuru rusange ku bushakashatsi.
- icyemezo cyo kugira uruhare mu bushakashatsi uza gushyiraho umukono nubyemera.

Igice cya I: Amakuru rusange ku bushakashatsi

Nitwa UMULISA Olive, ndi umunyeshuri muri Kaminuza y’u Rwanda mu cyiciro cya gatatu mu ishami ry’Ubuzima Rusange. Ndigukora ubushakashatsi ku ibura ry’amazi kikaba ari ikibazo cy’ingutu mu mujyi wa Kigali. Ngiye kubaha amakuru rusange arebana n’ubu bushakashatsi mbasabe kugira uruhare muri bwo ariko ibyo biraterwa n’ubushake bwanyu. Aho muzajya mugira icyo mutumva muzajya munsobanuza.

Intego y’ubushakashatsi

Ubu bushakashatsi bugamije kugaragaza isano Ibura ry’amazi rifitanye n’ibikorwa by’isuku n’isukura mu ngo ziboneka mu murenge wa Nyarugunga mu mujyi wa Kigali mu rwego rwo gutanga amakuru azifashishwa na WASAC hamwe n’abandi bafatanyabikorwa mu kureba ingamba zafatwa mu gukemura iki kibazo.

Abakenewe mu bushakashatsi

Hakenewe abantu b’igitsinagore bakuriye ingo ziboneka mu murenge wa Nyarugunga .

Kugira uruhare mu bushakashatsi

Kugira uruhare muri ubu bushakashatsi ni uburenganzira bwa buri muntu ku giti cye. Umuntu niwe ubiyemerera ku bushake bwe.

Igihe igikorwa kizamara

Gusubiza urupapuro rw'ibibazo biramara iminota 20.

Kugira icyo umuntu ahabwa

Nta mafaranga cyangwa ikindi kintu giteganywa gutangwa muri ubu bushakashatsi.

Kugira ibanga

Turabizeza ko amakuru yose azakusanywa muri ubu bushakashatsi azagirirwa ibanga kandi akabikwa ahantu hafunze. Itsinda ry'abashakashatsi niryo gusa rizamenya amakuru muzatanga.

Uburenganzira bwo kwanga kugira uruhare mu bushakashatsi cyangwa kuvamo

Kugira uruhare muri ubu bushakashatsi ni uburenganzira bwawe nta n'inkurikizi bizakugiraho uramutse ubuvuyemo ku bushake bwawe. Nuhitamo kugira uruhare muri ubu bushakashatsi ufite uburenganzira bwo kubuvamo ubishatse bitewe nuko wumva ko hari ikitagenda cyangwa bitewe n'indi mpamvu yawe. Ikindi mu gihe ubyemeye usabwa gushyira umukono ku ifishi yo kugira uruhare mu bushakashatsi yo kwemeza ko ubyemeye ku bushake ntawubiguhatiye.

Igice cya II: Icyemezo cyo kugira uruhare kubushake mu bushakashatsi

Amakuru nasomye ku bushakashatsi cyangwa bansomeye nayasobanukiwe. Nahawe umwanya wo kubaza ibibazo kandi byasubijwe neza nanyuzwe. Niyemeje kubushake kugira uruhare muri ubu bushakashatsi.

Amazina: _____

Umukono: _____

Itariki: _____

Indahiro y’umushakashatsi

Ndemeza ko uwifuza kugira uruhare mu bushakashatsi yahawe umwanya wo kubaza ibibazo kandi byasubijwe neza uko ntekereza. Ndemeza ko ntawamuhatiye kugira uruhare mu bushakashatsi, we ubwe niwe ubiyemereye kubushake bwe.

Amazina y’umushakashatsi_____

Umukono_____

Itariki _____

Aho kubariza

Niba ufite ikibazo ushobora kukibaza ubu cyangwa nyuma. Niba wifuza kuzabaza ikibazo nyuma ushobora kwandikira Kaminuza kuri uyu murongo: UR/CMHS e-mail: researchcenter@ur.ac.rw

Appendix II: Questionnaire on “Linkage between water shortage, Sanitation and Hygiene practices among the community of Nyarugunga Sector, Kigali City”

Date:.....

Village:.....

Cell :.....

Sector :.....

District :.....

Instruction:

- Please circle the letter or number corresponding to your answer
- You may pick more than one answer, select all that apply

SECTION 1: SOCIO-DEMOGRAPHIC INFORMATION OF RESPONDENTS

A.Gender :

1. Male
2. Female

B.Age.....

C.Marital status :

1. Single
2. Married
3. Divorced/Separated
4. Widowed

D.Household size:

1. One member to three members
2. 4-6
3. 7-9
4. Over 9 members

E.Education level

1. Illiterate
2. Primary
3. Secondary
4. University

F.Occupation

1. Unemployed
2. Casual worker
3. Employed
4. Self employed

SECTION 2: ACCESS TO WATER POINT SOURCE

1. What is the main source of drinking water for the members of your household?
 - a. Piped water into dwelling
 - b. Public tap
 - c. Borehole
 - d. Rain water
 - e. Spring
 - f. Surface water e.g lake, river
 - g. Other, specify.....

2. Is it always functioning?

- a. Yes
- b. No

3. When it is not functioning, how do you collect drinking water?

.....
.....

4. Do you experience water shortage in your household?

- a. Yes
- b. No

5. How do you perceive the quantity of water supplied in your area?
 - a. Insufficient
 - b. Sufficient
 - c. Abundant
6. When you don't have water in your premise, how long does it take to wait water at water point source?
 - a. < 30 minutes
 - b. Between 30 minutes one 1 hour
 - c. Between 1 hour and 2 hours
 - d. > 2 hours
7. What is the average distance travelled to reach the nearest water point source?
 - a. < 100 meters (m)
 - b. 100-200 m
 - c. 200-500 m
 - d. 500 m-1 km
 - e. > 1km
8. If your household is connected to WASAC pipeline, when do you get water?
 - a. Every day
 - b. Twice or three times per week
 - c. Once a week
 - d. Once in two weeks
 - e. Beyond two weeks
9. If your household is connected to WASAC pipeline, when did you get water during the last six months?
 - a. Every day
 - b. Twice or three times per week
 - c. Once a week
 - d. Once in two weeks
 - e. Beyond two weeks

10. If your household is connected to WASAC pipeline, during this research do you have now water in the tap?
- Yes
 - No
11. Did you get water today in the tap?
- Yes
 - No
12. For the days mentioned, how many hours in a day is water available in the tap?
- The whole day
 - 1-3 hours
 - 4-6 hours
 - 7-12 hours
13. What is the estimated daily consumption of water in your household?
- 3 jerrycans to 4 jerrycans
 - 5-6
 - 7-8
 - 9-10
 - Over 10
14. What is the estimated daily consumption of water per capita?
- Under 20 liters
 - 20 liters
 - 21-30 liters
 - 31-40 liters
 - 41-50 liters
 - Over 50 liters
15. Who fetch water in your household?
- The children
 - The mother
 - The mother and children

- d. The domestic helper
- e. The father
- f. The father and children
- g. Another paid person

16. Who has the responsibility of management of water in your household?

- a. The children
- b. The mother
- c. The domestic helper
- d. The father

SECTION 3: EFFECTS OF WATER SHORTAGE ON SANITATION PRACTICES

1. Do you have a functional toilet/latrine?
 - a. Yes
 - b. No
2. What type of toilet facility do the members of your household usually use?
 - a. Pit latrine with slab
 - b. Pit latrine covered with wooden poles
 - c. Flush or pour flush toilet
3. Do you share this toilet facility with other households?
 - a. Yes
 - b. No
4. If you have a flush toilet, do you get enough water to flush it?
 - a. Yes
 - b. No
5. Do you have any problem of maintaining your toilet clean?
 - a. Yes
 - b. No
6. If yes, what hinders you from maintaining your toilet clean?
 - a. Water for cleaning is not available
 - b. Cleaning materials are not available

- c. Too many users
 - d. Other users don't know how to use it
 - e. All
7. What are the effects of water shortage on cleaning toilet?
- a. There is bad odor in the toilet
 - b. There are flies in the toilet
 - c. Feces and urine are not properly disposed due to dirty toilet
 - d. People could be contaminated by the diseases due to poor hygiene
 - e. All
8. Is there a place for hand washing near the toilet facility?
- a. Yes
 - b. No
9. Are the clean water and soap always available at the place for hand washing?
- a. Yes
 - b. No

SECTION 4: EFFECTS OF WATER SHORTAGE ON HYGIENE PRACTICES

1. What do you skip doing when there is water shortage in your household?
- a. Cooking food
 - b. Drinking water
 - c. Cleaning house
 - d. Taking bath
 - e. Hand washing
 - f. Washing clothes
 - g. Washing dishes
 - h. Garden watering
 - i. Cleaning the toilet
2. During your menstruation or the menstruation of another person of your household do you get enough water for personal hygiene and materials used?
- a. Yes

- b. No
3. Is there some diseases caused by poor hygiene due to water shortage?
- a. Yes
 - b. No
4. What are the diseases caused by poor hygiene due to water shortage?
- a. Intestinal worms
 - b. Diarrhea
 - c. Cholera
 - d. Dysentery
 - e. Typhoid
 - f. All
 - g. I don't know
5. In the last 6 month, has any member of your household suffered from any disease caused by poor hygiene due to water shortage?
- a. Yes
 - b. No
6. If yes, which disease the member suffered from?
- a. Intestinal worms
 - b. Diarrhea
 - c. Cholera
 - d. Dysentery
 - e. Typhoid
 - f. I don't know

Thanks!

Ibibazo bijyanye n’ “ Isano Ibura ry’Amazi rifitanye n’Ibikorwa by’Isuku n’Isukura mu ngo zo mu murenge wa Nyarugunga mu mujyi wa Kigali”

Itariki:.....

Umudugudu:.....

Akagari :.....

Umurenge :.....

Akarere :.....

Icyitonderwa :

- Koresha akaziga ku nyuguti cyangwa umubare bibanziriza igisubizo cyawe
- Ibisubizo bishobora kuba byinshi (icyo gihe byose ubishyiraho akaziga)

IGICE I : AMAKURU YEREKERANYE N’USUBIZA

A.Igitsina :

1. Gabo
2. Gore

B.Imyaka ufite.....

C. Irangamimerere

1. Ingaragu
2. Ndubatse
3. Natandukanye n’uwo twashakanye
4. Umupfakazi

D.Umubare w’abantu baba mu rugo

1. Umuntu umwe kugeza ku bantu batatu
2. Abantu 4- 6
3. Abantu 7- 9
4. Hejuru y’abantu 9

E.Amashuri wize

1. Ntabwo nize
2. Amashuri abanza
3. Amashuri yisumbuye
4. Kaminuza

F.Umurimo ukora

1. Nta kazi ngira
2. Nyakabyizi
3. Mfite akazi
4. Ndikorera ku giti cyanjye

IGICE 2 : KUBONA AMAZI MEZA

1. Ni hehe muvoma amazi mukoresha mu rugo iwanyu?
 - a. Dufite amazi mu rugo
 - b. Robine rusange
 - c. Bowahole
 - d. Amazi y'imvura
 - e. Ivomo rusange
 - f. Mu kiyaga cyangwa mu mugezi
 - g. Ahandi , havuge.....
.....
2. Ese uburyo mukoresha muvoma amazi butuma muhorana amazi buri gihe?
 - a. Yego
 - b. Oya
3. Niba igisubizo ari oya, mubona amazi mute?.....
.....
.....
4. Ese mufite ikibazo cy'ibura ry'amazi mu rugo rwanyu?
 - a. Yego
 - b. Oya

5. Amazi mubona mu gace kanyu angana ate?
 - a. Ntahagije
 - b. Arahagije
 - c. Ni menshi

6. Iyo ntamazi mufite mu rugo bibafata umwanya ungana iki gutegereza amazi ku ivomo?
 - a. Iminota iri munsi ya 30
 - b. Iminota iri hagati ya 30 n'isaha imwe
 - c. Hagati y'isaha imwe n'amasaha 2
 - d. Hejuru y'amasaha 2

7. Ese hareshya gute kugera ku ivomo?
 - a. Munsi ya metero (m)100
 - b. Hagati ya m 100 na m 200
 - c. Hagati ya m 200 na m 500
 - d. Hagati ya m 500 na kilometero imwe
 - e. Hejuru ya kilometero imwe

8. Niba mugira amazi mu rugo, amazi aboneka ryari?
 - a. Buri munsi
 - b. Kabiri cyangwa gatatu mu cyumweru
 - c. Rimwe mu cyumweru
 - d. Rimwe mu byumweru bibiri
 - e. Hejuru y'ibyumweru bibiri

9. Niba mugira amazi mu rugo, mugereranyije mu mezi atandatu ashize amazi yabonekaga ryari mu rugo?
 - a. Buri munsi
 - b. Kabiri cyangwa gatatu mu cyumweru
 - c. Rimwe mu cyumweru
 - d. Rimwe mu byumweru bibiri
 - e. Hejuru y'ibyumweru bibiri

10. Niba mugira amazi mu rugo, muri uyu mwanya w'ubushakashatsi mbese amazi yaba ari kuza muri robine?
- Yego
 - Oya
11. Niba ari OYA , harubwo amazi yigeze aza uyu muni akongera akagenda?
- Yego
 - Oya
12. Iyo amazi yaje amara amasaha angahe aza?
- Umunsi wose
 - Isaha 1 kugera kuri 3
 - Amasaha 4-6
 - Amasaha 7-12
13. Mbese mugereranije ku muni mukoresha amazi angana iki mu rugo rwanyu?
- Ijerekani 3 kugera kuri 4 z'amazi
 - 5-6
 - 7-8
 - 9-10
 - Hejuru y'icumi
14. Mugereranije umuntu umwe yaba akoresha amazi angana iki ku muni?
- Muni ya litiro 20
 - Litiro 20
 - 21-30
 - 31-40
 - 41-50
 - Hejuru ya litiro 50
15. Ninde uvoma amazi mukoresha mu rugo?
- Abana
 - Umubyeyi w'umugore
 - Umubyeyi w'umugore n'abana
 - Umukozi

- e. Umubyeyi w'umugabo
- f. Umubyeyi w'umugabo n'abana
- g. Undi muntu twishyura

16. Ninde ufite inshingano yo gukurikirana uko amazi akoreshwa mu rugo?

- a. Abana
- b. Umubyeyi w'umugore
- c. Umukozi
- d. Umubyeyi w'umugabo

IGICE CYA 3: INGARUKA RY'IBURA RY'AMAZI KU ISUKURA

1. Mbese mufite ubwiherero?
 - a. Yego
 - b. Oya
2. Ni ubuhe bwoko bw'ubwiherero mukoresha mu muryango wanyu?
 - a. Umwobo utwikirije beto
 - b. Umwobo utwikirije ibiti
 - c. Ubwiherero bwo mu nzu bukoresha amazi
3. Ese hari urundi rugo muhuriye/musangiye ubwo bwiherero?
 - a. Yego
 - b. Oya
4. Niba mufite ubwiherero bwo mu nzu, ese mubona amazi ahagije yo gukoresha mu bwiherero?
 - a. Yego
 - b. Oya
5. Mbese mwaba mufite ikibazo kirebana no kugirira isuku ubwiherero bwanyu?
 - a. Yego
 - b. Oya
6. Niba ari yego, ni iki kibabuza gusukura ubwiherero bwanyu nkuko mubyifuza?
 - a. Kubura kw'amazi

- b. Ibikoresho by'isuku ntabyo
 - c. Ubwiherero bukoreshwa n'abantu benshi
 - d. Abandi bantu bakoresha ubwiherero ntibabukoresha neza
 - e. Byose
7. Ni izihe ngaruka z'ibura ry'amazi ku isuku y' ubwiherero?
- a. Mu bwihereho habamo impumuro mbi
 - b. Mu bwihereho hazamo amasazi
 - c. Hari igihe inkari n'umwanda bituma biba binyanyagiye mu bwihereho, abantu batitumye ahakwiye
 - d. Abantu bashobora kwandura indwara zitewe n'isuku nke
 - e. Byose
8. Ese hari ahantu mugira ho gukarabira intoki hafi y'ubwiherero?
- a. Yego
 - b. Oya
9. Ese harubwo amazi meza n'isabune biboneka buri gihe aho gukarabira intoki?
- a. Yego
 - b. Oya

IGICE CYA 4: INGARUKA RY'IBURA RY'AMAZI KU ISUKU

1. Ni ibiki musubika gukora igihe amazi yabaye make murugo?
- a. Guteka ibyo kurya
 - b. Kunywa amazi
 - c. Gukoropa mu nzu
 - d. Kwiyuhagira umubiri wose
 - e. Gukaraba intoki

- f. Kumesa imyenda
 - g. Koza amasahane/ibyombo
 - h. Kuvomera ubusitani
 - i. Gukoropa mu bwiherezo
2. Ese iyo uri mu mihango cg undi muntu uri mu rugo ari mu mihango mubona amazi ahagije yo gukaraba no kumesa imyenda ishobora kuba yanduye?
 - a. Yego
 - b. Oya
 3. Ese ibura ry'amazi rishobora kuba intandaro yo kurwara indwara bitewe n'isuku nke?
 - a. Yego
 - b. Oya
 4. Ni izihe ndwara abantu bashobora kurwara zitewe n'isuku nke yakomotse kw'ibura ry'amazi?
 - a. Inzoka zo mu nda
 - b. Indwara yo gucibwamo
 - c. Kolera
 - d. Macinya
 - e. Tifoyide
 - f. Zose
 - g. Ntabwo mbizi
 5. Mu mezi atandatu ashize haba hari umuntu wo muri urugo wigeze arwara imwe mu ndwara ziterwa n'isuku nke yakomotse kw'ibura ry'amazi?
 - a. Yego
 - b. Oya
 6. Niba ahari yaba yararwaye iyihe ndwara muri izi zikurikira:
 - a. Inzoka zo mu nda

- b. Indwara yo gucibwamo
- c. Kolera
- d. Macinya
- e. Tifoyide

Murakoze!

Appendix III: Interview guides with key informants

A. Interview guide with the Manager of WASAC/Kanombe branch

1. How is the situation of water shortage in Nyarugunga Sector?
(Ikibazo cy'ibura ry'amazi giteye gite mu murenge wa Nyarugunga?)
.....
.....
2. What are the factors contributing to water shortage in Nyarugunga Sector?
(Ni ibiki bitera ibura ry'amazi mu murenge wa Nyarugunga?)
.....
.....
3. What are the effects of water shortage on hygiene and sanitation practices at household level?
(Ni izihe ngaruka zibura ry'amazi ku bikorwa by'isuku n'isukura mu ngo?)
.....
.....
4. What have you done so far to mitigate the effect of water shortage in Nyarugunga Sector?
(Ni ibiki mwakoze mu rwego rwo kurwanya ingaruka zibura ry'amazi mu murenge wa Nyarugunga?)
.....
.....
5. What is your advice to Nyarugunga residents on how to cope with water shortage?
(Ni izihe nama mutanga ku batuye umurenge wa Nyarugunga zo guhangana n'ibura ry'amazi ?)
.....
.....
6. As institution of supplying water to people, what are the strategies to overcome the water shortage in Nyarugunga Sector?
(Nk'ikigo gishinzwe kugeza amazi meza ku baturage, ni izihe ngamba mufite zo gukemura ikibazo cy'ibura ry'amazi mu murenge wa Nyarugunga?)

B. Interview guide with the Executive Secretary of Nyarugunga Sector

1. How is the situation of water shortage in Nyarugunga Sector?

(Ikibazo cy'ibura ry'amazi giteye gite mu murenge wa Nyarugunga?)

.....
.....

2. What are the factors contributing to this situation of water shortage in Nyarugunga Sector?

(Ni ibiki bitera ibura ry'amazi mu murenge wa Nyarugunga?)

.....
.....

3. What are the effects of water shortage on hygiene and sanitation practices at household level?

(Ni izihe ngaruka zibura ry'amazi ku bikorwa by'isuku n'isukura mu ngo?)

.....
.....

4. What have been done so far to mitigate the effect of water shortage in Nyarugunga Sector?

(Ni ibiki byakozwe mu rwego rwo kurwanya ingaruka zibura ry'amazi mu murenge wa Nyarugunga?)

.....
.....
.....

5. What are the strategies to overcome the water shortage in Nyarugunga Sector?

(Ni izihe ngamba mufite zo gukemura ikibazo cy'ibura ry'amazi mu murenge wa Nyarugunga?)

.....
.....

C. Interview guide with the Head of Nyarugunga Health Center

1. What is the situation of water shortage in Nyarugunga Sector?

(Ikibazo cy'ibura ry'amazi giteye gite mu murenge wa Nyarugunga?)

.....
.....

2. What are the effects of water shortage on hygiene and sanitation practices at household level?

(Ni izihe ngaruka z'ibura ry'amazi ku bikorwa by'isuku n'isukura mu ngo?)

.....
.....

3. Is there some cases of water related diseases do you receive in this Health Center?

(Ese haba hari abantu muvura baba barwaye indwara zifitanye isano n'amazi yakoreshejwe Atari meza?)

.....
.....

4. Which water related diseases do you receive in this Health Center?

(Ni izihe ndwara abantu mwakira bakunze kuba barwaye?)

.....
.....

5. What is their prevalence?

(Izo ndwara zaba ziri ku kihe gipimo?)

.....
.....

D. Focus group discussion guide with Community members

1. What is the situation of water shortage in your living area?

(Ikibazo cy'ibura ry'amazi giteye gite mugace mutuyemo?)

.....
.....

2. How do you manage the water shortage in your households?

(Ni gute muhangana n'ibura ry'amazi mungo zanyu?)

.....
.....

3. What are the factors contributing to water shortage in your living area?

(Ni ibiki bitera ibura ry'amazi mugace mutuyemo?)

.....
.....

4. What are the effects of water shortage on hygiene and sanitation practices at household level?

(Ni izihe ngaruka z'ibura ry'amazi ku bikorwa by'isuku n'isukura mu ngo?)

.....
.....

5. What are the strategies to cope with the water shortage in your living area?

(Ni izihe ngamba mufite zo gukemura ikibazo cy'ibura ry'amazi mugace mutuyemo?)

.....
.....

Appendix IV: Consent forms for key informants

A. Consent form for key informants

Hello, my name is **UMULISA Olive**, I am student at University of Rwanda in the program of Master's in Public Health. I am conducting a research in your community. The research aims to determine the linkage between water shortage, sanitation and hygiene practices among the community of Nyarugunga Sector in order to provide information to WASAC and other partners to manage appropriate interventions to that issue.

Thank you for agreeing to speak to me today. I am interested in learning from your experience and understanding your thoughts on this issue.

I will take notes so that, I can remember all your important comments, but your name or personal details will not be attached to the ideas/comments you share with me. You can end the interview at any time.

Do you have questions for me?

Are you ready to participate in this interview?

Can we start by sharing your name, the name of your organization and your role?

Name: _____

Organization_____Title_____

Signature_____

Date_____

Ifishi yo gutanga uburenganzira bwo kugirana ikiganiro

Muraho! Nitwa UMULISA Olive, ndi umunyeshuri muri Kaminuza y'u Rwanda mu cyiciro cya gatatu cy'ubuzima rusange. Ndigukora ubushakashatsi mu gace kanyu bugendereye kugaragaza isano ibura ry'amazi rifitanye n' ibikorwa by'isuku n'isukura mu ngo ziboneka mu murenge wa Nyarugunga. Ibyo bizafasha mugutanga amakuru yakwifashishwa na WASAC hamwe n'abandi bafatanyabikorwa mu gushakira umuti icyo kibazo.

Mwakoze kuba mwemeye kugirana ikiganiro nanjye uyu muni. Nejejwe no kwigira kwinararibonye ryanyu no kumva ibitekerezo byanyu ku nsanganyamatsiko yacu. Ndagenda nandika ingingo z'ingenzi z'ikiganiro tugirana kugira ngo nzibuke ibyo twaganiriye ariko nagira ngo mbizeze ko amazina yanyu ntayashyira kubitekerezo mutanga. Mushobora guhagarika ikiganiro igihe cyose mubishakiye kandi ntankurikizi yababaho.

Mbese hari ikibazo mufite?

Mbese mwiteguye kugira uruhare muri iki kiganiro?

Niba mubinyemereye nimwandike amazina yanyu, aho mukora n'icyo mukora kuri ino fishi.

Amazina: _____

Aho mukora: _____ Icyo mukora: _____

Umukono: _____

Itariki: _____

B. Consent form for Focus Group Discussions (FGD)

Hello everyone, my name is **UMULISA Olive**, I am student at the University of Rwanda/School of Public Health/MPH. I am conducting a research in your community. The research aims to determine the Linkage between water shortage, sanitation and hygiene practices among the community of Nyarugunga Sector in order to provide information to WASAC and other partners to manage appropriate interventions to that issue.

Thank you for agreeing to participate in group discussion today. I will ask the group a question and then facilitate sharing your opinions on the subject and I will take notes so that, I can remember all your important comments. I am not here to give my opinion, but I am only interested in hearing yours. I hope you feel comfortable for sharing your experiences and perceptions and talking honestly.

However, I would like to reassure everyone that this group discussion is confidential; no one outside the group will know who was told what, and your name will not be attached to comments you might make during our discussion.

Do not hesitate to answer a question. You do not have to wait to be called, but please allow the speaker to finish his or her thoughts before starting to speak. It will be much easier to follow the discussion if only one person speaks at a time. Please be respectful of all points of view that will be given during the discussion.

Your participation in the group is entirely your choice, and you can choose to stop participating and leaving the group at any time without consequence for you. Does anyone have questions?

Are you ready to participate in this research? (Do you ensure the verbal consent of all participants?)

So that we all know each other, can we start by going around the circle and introduce yourself?

Thank you!

Ifishi yo gutanga uburenganzira bwo kugirana ikiganiro mu itsinda

Muraho mwese! Nitwa UMULISA Olive, ndi umunyeshuri muri Kaminuza y'u Rwanda mu cyiciro cya gatatu cy'ubuzima rusange. Ndigukora ubushakashatsi mu gace kanyu bugendereye kugaragaza isano ibura ry'amazi rifitanye n' ibikorwa by'isuku n'isukura mu ngo ziboneka mu murenge wa Nyarugunga. Ibyo bizafasha mugutanga amakuru yakwifashishwa na WASAC hamwe n'abandi bafatanyabikorwa mu gushakira umuti icyo kibazo.

Murakoze kuba mwemeye kugirana ikiganiro nanjye mu itsinda uyu muni. Ndagenda mbaza ibibazo ku nsanganyamatsiko yacu kandi nyobora n'ikiganiro kugira ngo mutange ibitekerezo byanyu uko mubyumva. Ndandika ibitekerezo mutanga kugira ngo nzibuke ingingo zingenzi mwanze. Ntabwo naje kubagezaho ibitekerezo byanjye kuri yo ahubwo ndanzezewa no kumva ibyanyu. Ndizera muri bwisanzure mukambwira mubyukuri uko ibintu mubibona.

Gusa nagira ngo nizeze buri muntu ko ikiganiro tugirana ari ibanga hagati yacu. Nta muntu wo hanze ugomba kumenya ngo naka yavuze ibi cyangwa ngo dushyire amazina kubyo umuntu yavuze muri iki kiganiro.

Ntimushidikanye kugira ikibazo musubiza cyangwa gutegereza ko bavuga usubiza uwo ariwe birakorwa kubushake bwanyu ariko birasaba kuvuga undi muntu wavugaga yarangije kuvuga, kugira ngo habeho kubahana. Byoroha kumva umuntu umwe atanga igitekerezo cye avuga ari wenyine. Twubahe ibivugirwa muri iki kiganiro.

Kugira uruhare muri iki kiganiro ni ubushake bwanyu kandi ushobora guhagarika kugira uruhare muri iki kiganiro igihe cyose ubishakiye kandi nta n'inkurikizi bishobora kukugiraho.

Mbese hari umuntu ufite ikibazo kubyo maze kubabwira?

Mbese mwese mwiguye kugira uruhare muri ubu bushakashatsi? Mutanze uburenganzira bwo kugirana ikiganiro?

Kugira ngo tunganire tuziranye reka twicare kuruziga noneho buri wese agende avuga amazina mbere yuko dutangira ikiganiro.

Murakoze!