



Norwegian University
of Life Sciences

Master's Thesis 2020 30 ECTS

Norwegian University of Life Sciences
Department of International Environmental and Development Studies
The Faculty of Landscape and Society

Human Mindset, Attitudes, and Behaviors as Drivers of Poor Water Quality Management in Gahkuch, Gilgit-Baltistan

Zoya Arshad

International Environmental Studies

Human Mindset, Attitudes, and Behaviors as Drivers of Poor Water Quality Management in Gahkuch, Gilgit-Baltistan



Master's thesis

by Zoya Arshad

Norwegian University of Life Sciences

Department of International Environment and Development Studies

July 2020

The Department of International Environment and Development Studies, Noragric, is the international gateway for the Norwegian University of Life Sciences (NMBU). The university comprises of eight departments, associated research institutions and the Norwegian College of Veterinary Medicine in Oslo. Established in 1986, Noragric's contribution to international development lies in the interface between research, education (Bachelor, Master and PhD programs) and assignments.

The Noragric Master theses are the final theses submitted by students in order to fulfill the requirements under the Noragric Master program "International Environmental Studies", "Development Studies" and other Master programs.

The findings in this thesis do not necessarily reflect the views of Noragric. Extracts from this publication may only be reproduced after prior consultation with the author and on condition that the source is indicated. For rights of reproduction or translation contact Noragric.

© Zoya Arshad, July 2020

zoya.arshad13@gmail.com

Noragric

Department of International Environment and Development Studies

P.O. Box 5003

N-1432 Ås

Norway

Tel.: +47 67 23 00 00

Internet: <https://www.nmbu.no/fakultet/landsam/institutt/noragric>

DECLARATION

I, Zoya Arshad, declare that this thesis is a result of my own research investigations and findings. Sources of information other than my own have been acknowledged and a reference list has been appended. This work has not been previously submitted to any other university for award of any type of academic degree.

Signed: Zoya Arshad

Date: 02/07/2020

Acknowledgements

I am very thankful to the Department of International Environment and development studies and to the university (NMBU) for allowing me to undertake this thesis work to mark the end of my studies.

I would like to express my sincere gratitude to my supervisor, Mr. Bishal K. Sitaula for his time, valuable guidance and constructive feedbacks that inspired and motivated me to complete this dissertation. Also, I would like to express my gratitude to my field supervisor, Dr. Karamat Ali for his invaluable guidance throughout my fieldwork.

I offer sincere thanks to my friends for the constant help for dissertation preparation with invaluable discussion, suggestions, and motivation.

And of course, my deepest gratitude to my family and specially my brother for their motivating support, inspiration and understanding during the study and writing process.

Abstract

Population growth and development result in increased generation of waste causing drinking water sources to degrade. In Pakistan, poor water quality is one of the major environmental and health concern. Human mindset, knowledge, attitude, and behavior substantially define the quality of environment. This study was therefore aimed at examining human dimensions of water quality issues and constraint that human attitudes place on water quality management, in Gahkuch, Gilgit-Baltistan. This study made use of the quantitative survey questionnaires and semi-structured interviews to collect primary data. Recent literature on the water quality management and human attitudes was employed in the interpretation of the data. The results from this research include limitations in knowledge of environmental and health risks, community-based management, and insufficient implementation of water quality legislation. Local people are unaware of the consequences of their degrading behavior on the water sources and on their own health. The study suggests that to achieve effective water quality management, awareness campaigns, environmental education, active community participation and increased enforcement of legal measures can play major role.

Keywords: Water Quality Management, Human Dimensions, Attitudes, Mindset, Awareness

Table of Contents

Chapter 1 INTRODUCTION.....	1
1.1 Background	1
1.2 Problem Statement	3
1.3 Objectives of the study.....	5
1.4 Research Questions	5
1.5 Significance of study	6
1.6 Outline of thesis	7
CHAPTER 2: LITERATURE REVIEW	8
2.1 Literature	8
2.1.1 Social norms and Attitudes	8
2.1.2 Mindset and Behavior	10
2.1.3 Water quality management	11
2.1.4 Public Perception of Water Quality Risks	12
2.1.5 Environmental Education and Community Participation	12
2.2 Empirical literature.....	13
2.3 Theoretical Frameworks.....	15
2.3.1 Norm Activation Model (NAM).....	16
2.3.2 Reasoned/Responsible Action Theory	18
2.3.3 Health belief theory.....	19
3 CHAPTER 3: RESEARCH METHODOLOGY	22
3.1 Overview of methodology.....	22
3.2 Research design.....	23
3.3 Study area and population of study	23
3.4 Sampling procedure and sample size	25
3.5 Data collection.....	25
3.6 Data analysis	27
3.7 Validity and reliability of data collected	28
3.8 Ethical compliance	28
3.9 Limitations and Challenges of the study	29
4 CHAPTER 4: RESULTS AND DISCUSSION	30

4.1	PART A: Questionnaire Analysis and Interpretation.....	30
4.1.1	Section A: Demographic characteristics of respondents	30
4.1.2	Primary water quality and management	33
4.2	PART B: Interview interpretation	50
4.2.1	Section A: Reasons behind human related water quality issues	51
4.2.2	Section B: Human attitudes, mindset and behaviors pertaining to water pollution	55
4.2.3	Section C: Barriers and enablers for improvement of water quality management .	58
	CHAPTER 5 CONCLUSION AND RECOMMENDATIONS	62
5.1	Conclusion.....	62
5.2	Recommendations	63
	References.....	65
	Appendices.....	i

List of Figures

Figure 1 Norm Activation Model (Schwartz, 1977)	16
Figure 2 Theory of Reasoned/Responsible Action (Ajzen and Fishbein 1980)	19
Figure 3 Health Belief Model (Janz and Becker, 1984)	20
Figure 4 Theoretical Framework for the study	21
Figure 5 Map of study area; Gahkuch, Gilgit-Baltistan.....	24
Figure 6 Age of Respondents.....	30
Figure 7 Education of Respondents	31
Figure 8 Number of Family Members per Household.....	32
Figure 9 Number of Children per Household	33
Figure 10 Main sources of Water Supply to Households	34
Figure 11 How often is water treated before consumption?	35
Figure 12 Perceived Quality of Drinking Water by the Respondents.....	36
Figure 13 Shortage of water faced by the population	37
Figure 14 Perceived Contamination of Drinking Water by the Respondents.....	38
Figure 15 Health of Household Effected due to Water Contamination.....	39
Figure 16 Common Water-borne Diseases of the Respondents	40
Figure 17 Type of Toilet in the Household of the Respondents	42
Figure 18 Reasons for Open Dumping of Household Waste Materials.....	43
Figure 19 Correlation of Level of Education with Waste Dumping Practice	44
Figure 20 Correlation of Level of Education with the Practice of Polluting Water Sources.....	45
Figure 21 Municipal Solid Waste Dumped near the River.....	47
Figure 22 Water Tank for Drinking Water Supply	53

Figure 23 Water Tank Contaminated with Solid Waste Materials	53
Figure 24 Washing of Utensils by a Roadside Restaurant.....	54
Figure 25 Cloth Washing in Water Stream.....	54

List of Tables

Table 1 Constraints on Water Quality Management.....	46
Table 2 Social, Technological and Economic Constraints.....	47
Table 3 Options to Change People's Attitudes and Behaviors.....	49

List of Abbreviations

AC	Awareness of Consequences
AKRSP	Aga Khan Rural Support Program
AR	Ascription of Responsibility
DALYs	Disability Adjusted Life Years
EE	Environmental Education
NAM	Norm Activation Model
PEPC	Pakistan Environmental Protection Agency
WASEP	Water and Sanitation Extension Program
WHO	World Health Organization

Chapter 1 INTRODUCTION

This chapter provides background to the study, problem statement, research questions that are addressed in this study, and the identified objectives would be discussed. The significance of study and an overview of the thesis would be stated.

1.1 Background

Safe drinking water is an integral right of humans to ensure good health and well-being. In most parts of the world, freshwater resources are gradually decreasing and expected to decline in availability mainly due to increase in population, urbanization and changing climate (Jackson et al., 2001). Recent estimates as reported by Mohsin et al., (2013) showed that the quantity of water is greatly decreasing in the developing countries of South Asia, Middle East, and Africa. The quality of fresh water is deteriorating rapidly due deforestation, soil erosion, rapid urbanization, and other physical, chemical, and biological degradation of land. Developing countries such as, Pakistan, is increasingly experiencing contamination of drinking water. Most likely due to industrial expansion, increased wastewater, and chemical effluent disposal into the freshwater resources. All are contributing to the poor quality of drinking water, and thus becoming hazardous for human use with increased heavy metal contents (Khan and Hanjra, 2008; Baig et al., 2019).

Waterborne diseases cause a substantial damage to human well-being, In Pakistan, one of the main environmental and health concerns is related to poor water quality (PCRWR, 2019). Biological and chemical wastes pollute both the surface and groundwater resources of the country (Nabeela et al., 2014). A majority of the population is deprived of clean drinking water sources as shown by National statistics, only 56% of the population of Pakistan has access to safe drinking water. While rural areas of the country have even less access, hardly reaching to 45% of the population (Farooq

et al., 2008). When people do not have access to safe drinking water, they have higher risk and vulnerability to water-related health issues. In Pakistan, waterborne diseases mainly result from anthropogenic activities, constituting to 80% of the total diseases and 33% of deaths (Daud et al., 2017).

Pakistan is more seemingly is experiencing the issue of municipal waste from last two decades. Solid waste management has continued to be a major challenge for the country (Guerrero et al., 2013). The unhealthy conditions created due to improper disposal and treatment of solid waste make people more vulnerable to health-related risks. The problem appears to worsen with each passing year (Hussain et al., 2016). In Gilgit, solid waste is openly dumped, with no proper covering. Due to the lack of sufficient waste treatment facilities, it is openly burnt leading to air and water pollution (GB-EPA, 2013). Improper disposal of waste without the proper preventive measures may have resulted in spread of various disease-causing agents. This has an important implication for vector borne diseases and environmental degradation (Hussain et al., 2016).

Some studies have been conducted on assessment of drinking water quality in Gilgit. Such as fecal and total coliform count assessment by Ali et al. (2014), physical and chemical assessment by Begum et al. (2014), physico-chemical analysis by Sohail et al. (2019) biological water assessment (Daud et al., 2017) and bacteriological water assessment (Nafees et al., 2014). Findings of all these studies indicated that numerous surface water sources of Gilgit-Baltistan including Gilgit river, Ghizer river, streams, springs, and wells are contaminated and unsafe for human consumption. However, there is paucity of information on human dimension of the problem as a deeply rooted causal factor.

It is generally reported by researchers and environmental activists that people can significantly contribute to the improvement of quality of environment by properly disposing off the garbage

(Abdul-Muhmim, 2007). The knowledge, attitudes and practices of consumers largely define the quality of environment (Mansaray and Abijoye, 1998). The level of involvement of people in environmental protection processes governs their engagement in environmentally friendly activities such as recycling. These activities are also influenced by the feeling of moral obligation that people have towards protection of environment. These environmental behaviors can be characterized as morally demanding, which makes the consumer protect the environment and save natural resources of the earth that are already limited (Chen, 2010).

A fundamentally new approach is needed for securing water resources and human development. As the great scientist Albert Einstein said: *“You cannot solve a problem within the same mindset that created it”*. The human mindset that has dominated over the use of water resources in the past two centuries. This is because water bodies such as, lakes, rivers, and associated watersheds are important sources of human and economic development. With a utilitarian mindset, humans have been degrading water resources for their own benefits. This mindset have served us well when there was abundant of water on the planet, but now as the water resources are depleting and quality of leftover water is degrading, if this mindset persists, it will no longer provide benefits but harm to human well-being (Postel, 2003).

1.2 Problem Statement

Wherever a human civilization and development continues over time, increasing quantities of waste will be generated. Societies adopt different methods of waste management, but due to rapidly increasing population in the developing countries, poorly managed waste generation is also increasing, and current solid waste management methods are no more effective (Guerrero et al., 2013). Various diseases are transmitted by the use of contaminated water (Nabeela et al., 2014). Water contaminated by pathogenic microbes and parasitic organisms transmits water-borne

diseases such as, diarrhea, malaria, vomiting, dysentery, and kidney problems (Butt and Iqbal, 2007; Baig et al., 2019). These infectious pathogens are spread and sustained in environment largely due to human activities. Children and other vulnerable group of people are majorly affected by these water-borne diseases by the use of contaminated water. Every year in Pakistan, 53,000 children under the age of 5 die due to diarrheal diseases (Unicef and WHO, 2009). To reduce these water-borne diseases, availability of clean water and safe disposal of waste need to go together through proper management principles including human dimensions.

When people believe themselves to be an owner of nature and that they have a right on nature, they treat the environment as they wish. This becomes worse, as long as there is no strong legislation and law enforcement established and assessed over regular intervals. Otherwise their taken for granted assumptions become a mindset of people which drives their attitudes and behaviors leading this to become a social norm (Schwartz, 1977). A prevalent attitude of people in some developing countries leads them to throw garbage and solid waste openly. This fairly common practice of people from many developing countries, including Pakistan that potentially cause environmental deterioration. This is obvious that the unmanaged waste materials by one or another way ends up into water bodies, polluting them and causing harm to human health. When water upstream is polluted, it takes the contaminants along its flow to downstream. A study by Ali et al. (2014) about water quality assessment of Gilgit river presented that the downstream water samples showed the highest concentration of biological waste

Water quality in Gilgit-Baltistan is deteriorating due to chemical and biological pollutants and sediment concentration (Begum et al., 2014; Sohail et al., 2019). Human activities in the surroundings of water system are the main cause of water quality degradation (Shedayi et al., 2015). It is hypothesized that human dimensions of water quality issues could be rooted in the

paucity of knowledge and awareness, which may motivate people to adopt degrading environmental behaviors. If these challenges are not resolved, they will result in great environmental crisis. However, if in combination to effective policy framework, education, knowledge, and awareness of the population may result in decreased degradation of water resources. Such integrated approach including human dimension is required to effectively manage water resources. As human activities contribute mainly to the water quality issues, identifying the potential barriers and enablers in changing human attitude and behavior will go a long way in ensuring water quality management.

1.3 Objectives of the study

This study seeks to achieve following objective:

1. To review and analyze existing literature on human dimensions of water quality issues.
2. To investigate existing water quality issues related to human health in the study area.
3. To explore the attitudes and behaviors of local population relevant to water quality management in the study area.
4. To investigate the barriers and enablers for improving water quality and the need for transformative thinking.

1.4 Research Questions

With the aim of addressing the above objectives, the research activities are guided by the following research questions:

1. What are the sources of drinking water contamination in the study area?
2. What are the human dimensions that contribute to drinking water quality issues?

3. What kind of public attitudes, mindset, and behaviors are making constraints to mitigate water pollution problems?
4. What are the potential ways to influence public attitude change for improvement of water quality of the study area?

1.5 Significance of study

The challenges of waste disposal and its linkage to the degrading water quality is an important issue that needs to be examined at their root causes. The situation is even more catastrophic in many developing countries where technologies, education, and knowledge to ensure better management of water quality at their source are still lacking (Postel, 2003).

In this case study, we have chosen a semi-urban town of Gahkuch, in the developing state of Gilgit-Baltistan. The town of Gahkuch is having population of 12,500 and expected to increase at a rate of 1.9%, is experiencing water quality issues (District Health Office, 2019). This study is significant because it would provide an empirical framework for determining the various enablers.

The study aims to identify the barriers in adoption of effective water management in Gahkuch town, therefore, and would prove to be relevant for other areas. The information generated from this study could prove to be a source of valuable information for decisionmakers and policy designers who are involved in formulation and implementation of holistic water quality management. The study is also relevant as a base line or research reference point by providing insights of other researches for water management options in terms of education, knowledge, and awareness.

1.6 Outline of thesis

This study is organized into five chapters in order to present a structure and logical flow of concepts. The 1st chapter provides an introduction to the study, the background to the study, problem statement, research questions, objectives of study and significance of the study. Chapter 2 provides a review of relevant literature and a theoretical framework used to develop research questions and to analyze data. Chapter 3 describes the research methodology of the study which influences the results. Chapter 4 presents the research results and discusses the important research findings. Chapter 5 provides conclusions with summarizing findings and recommendations.

CHAPTER 2: LITERATURE REVIEW

This chapter provides an insight of the state of the art and the various concepts necessary for studying the water quality management and related human attitudes in the study area. To achieve the objective of understanding human mindset, attitudes and behavior relating to water quality management, the concept of social norms and attitudes will be examined. The constraints on water quality management due to human activities and public perceptions of risks in developing countries will be reviewed. A review of health effects from degraded water and related beliefs of people in developing countries and a review of global advances in water quality management will be presented. A review of relevant theories and previous empirical literature will also be presented.

2.1 Literature

2.1.1 Social norms and Attitudes

In the context of individual social responsibilities relevant for water quality management, both social norms and attitudes play an important role. Norms as defined by Schwartz (1977:130), are *'social specifications of desirable behavior in particular situations that provide the actor with potential directions for his or her action to take'*. While Vatn (2005:7) defined norms as, *'responses to questions regarding what is considered the right or appropriate behavior'*. Norms are centered around the values which they support and thus, internalized through life processes. Norms guide to differentiate what is the right behavior and what is the wrong behavior. Since norms are based on values, so when norms are followed, they support certain values.

At times, when people fail to adhere to norms, there can be some recognized social or legal sanctions. When such is the case, norms are not internalized in the individuals. However, even when legal regulations are present to constraint a behavior, social norms may still exist. Kinzig et

al. (2013) explains that the likelihood of being legally sanctioned for throwing a candy wrapper in a park is almost non-existent but people probably still resist from throwing around trash, not because of the fear of state regulations but because of social norms (e.g., “I wouldn’t want others to think I am the kind of person who litters”) or personal norms (e.g., “I’m not the kind of person who litters”).

Vatn (2005:123) states, *‘If norms are fully internalized, they are followed independently of whether others know and can punish those breaking the norm’*. However, when internalized norms are not followed which leads to a feeling of guilt of not behaving in a desirable manner. External sanctions are not needed when the feeling of guilt occurs, because then the individual would most likely behave as what is desirable. Furthermore, when norms are internalized, they eventually become habits of the individuals. When behaviors become habits, one no longer needs to make a decision, rather it becomes an automated act and the reasoning behind it is lost. Verplanken & Orbell, (2003) explain that, *‘by satisfactory repetition, behavior may become automatic in the sense that a specific response gets triggered by a specific cue in the environment’*.

The concept of attitude has been defined in a number of ways, mostly understood as the tendency to act in a certain manner, to a particular situation influenced by the values that a person holds. According to Allport (1935) attitude is defined as: *‘A mental and neural state of readiness, which exerts a directing, influence upon the individual’s response to all objects and situations with which it is related’*. Values are intrinsically present within a person or a group and are something that directs a person to behave in a certain way. Values influence attitudes and behaviors and it is assumed that there is a strong link between attitude and behavior because typically people’s behavior is consistent with their attitudes. The environmental quality management depends upon some critical factors such as, level of knowledge, attitudes, and values. Schultz and Zelezny (2000)

explain, *'attitudes of environmental concern are rooted in a person's concept of self and the degree to which an individual perceives him or herself to be an integral part of the natural environment'*.

However, contrary to that, Vandenberg (2004) stresses that the greatest issue faced by theorists and regulators is the effort of how to persuade people to act in a certain way that does not substantially benefit them and are not subject to any legal sanctions. The challenge is to unleash human potential to commit and care by breaking the habit of wrongdoing.

2.1.2 Mindset and Behavior

Human mindset, as studied by psychologists is a set of beliefs of a human that build his personality (Dweck, 2012). Dweck's theory of implicit belief describes two types of human mindsets: growth mindset (incremental belief) and fixed mindset (entity belief). People with fixed mindset believe that an individual's characteristics and beliefs are unchangeable while people with growth mindset hold a believe that human attributes are changeable and can be improved (Dweck and Leggett, 1988).

Human mindset can also depict how people view their surrounding environment (Swim et al., 2009). A fixed mindset would consider the environment to be static and unchangeable, hence it is negatively associated with individual's willingness to adopt pro-environmental behavior. While a growth mindset views environment to be malleable and can be improved, hence the probability of adopting pro-environmental behaviors increases (Soliman and Wilson, 2017). By extending Soliman and Wilson's (2017) research, Duchi et al. (2020) explain that a growth mindset is associated with pro-social attitudes, beliefs and positive intentions toward environmental mitigations and exhibit a major behavioral inclination. While holding a fixed mindset exhibit negative behavioral inclinations. However, there is still a paucity of studies on link between human mindset and pro-environmental behavior.

2.1.3 Water quality management

Globally, most of the attention has been and is still currently given to water quantity management and allocation of water resources (Biswas and Tortajada, 2011). Water quality continues to deteriorate due to poor water quality management, both socially and politically, in developing countries. Unfortunately, the government and the people of the developing countries are still unaware of the consequences of contaminated water for human health and ecosystem. So, if water crisis develops in future, it will not be because of water scarcity but because of rapidly deteriorating water quality in developing countries (Biswas and Tortajada, 2011).

As Biswas & Seetharam (2008), stress upon that even today water “quality” management lacks the due consideration as compared to water “quantity” management. However, water quality issues are more complex now than ever before while institutionally and academically water quantity issues are given more attention. The technical and management facilities that control water pollution are not very well established as compared to the ones that ensure excessive water quantity (Biswas, 2008).

There are various prominent problems related to uses of wastewater, particularly how it is described at present and what monitoring and interpreting practices are being taken nationally and internationally. One of the most prominent issue with water quality management is the amount of data required to take necessary measures for quality assurance. For water quantity assessment, only a few parameters are required, and they do not change with time. While, for water quality assessment various parameters such as, geographical location, type of pollutant, its effects on human health and the environment and the likelihood of continued discharge need to be calculated before applying essential management measures (Biswas & Tortajada, 2011). In major developed countries, drinking water quality and its impacts on human health are now being given due

diligence (Abbaspour, 2011). Developed countries with their higher capacities for research and developed technical and managerial systems have been able to monitor water supply systems more efficiently.

2.1.4 Public Perception of Water Quality Risks

In recent years, public perceptions have been growing about human health risks related to degraded drinking water quality. This has resulted in increased understanding of determinants of public perceptions and better ways to communicate these perceptions to the policymakers to encourage water quality management (Canter et al., 2005). However, developing countries and rural areas still lack awareness about water quality management and people's perceptions about risks are limited. As House (1996) argues, that general public judges quality of water resources primarily by its aesthetic appearance such as, visual and odorous characteristics. The color of water, its odor, presence of oil, litter, or other solid waste over the surface of water are the primary factors upon which public's perception towards freshwater and its use is based. However, the physical appearance of water has little or no connection to the biological or physico-chemical composition of water. Wisner et al. (2004) expresses that the motivation to manage the environment or mitigate the risk is limited when presence of risks is ignored. However, with the awareness of risks, one proactively takes action to protect oneself from the hazards.

2.1.5 Environmental Education and Community Participation

Due to the aggravating environmental problems, environmental education is being considered the most desirable theme, with the main objective to encourage environmentally friendly attitudes and behaviors (Alam, 2017). Environmental education can be defined as a process of understanding the interconnectedness of humans, their culture, and their biophysical surroundings (Palmer,

1998). However, this relationship is more complicated because some later studies showed that pro-environmental behavior is not always ensured by acquiring environmental knowledge (Ballentyne et al., 2000; Ajzen, 2002).

To change people's behaviors, attitudes, and motivations, practical opportunities of community participation play the most important role (Alam, 2017) and should not only be limited to schools or colleges (Aminrad et al., 2013). To encourage people for community participation, NGOs focus on understanding community's perspectives and empowering them (Gomez and Nakat, 2002). Communities interact with the environment and develop experience and knowledge, which makes them best advocates for improvement of water resources (Chifamba, 2013).

2.2 Empirical literature

Freshwater is already a limiting resource in most parts of the world and is at a risk of being exploited (Pradinaud, 2019). Unfortunately, in the developing countries due to rapid population growth, expansion of industries, and associated dumping of solid waste, effluents and wastewater into the freshwater resources has made these sources hazardous for human consumption. With the continuous increase in global population, demands for freshwater are also increasing. Socioeconomic development and lack of proper waste treatment facilities also put strain on the availability of freshwater in developing countries. Degradation of water quality leads to water scarce conditions for countries located in semi-arid and arid regions (Femiglietti, 2014). Water scarcity causes critical reduction in availability of freshwater for industrial, potable, and agricultural use. Thus, this shows the link of quantity of freshwater available to the quality of water which may limit the use (Peters and Meybeck, 2000).

Like other developing countries, Pakistan is also experiencing water pollution and critical water shortages. The country is ranked water stressed (PCRWR, 2019) and in near future expected to be water scarce, because its water resources are essentially exhausting (WWF, 2007). In Pakistan, degrading water quality is the major threat to public health, while surface waters are continuously poorly managed and monitored. Pakistan ranks at 80 out of 122 countries with degraded drinking water quality. Both surface and groundwater are contaminated throughout the country by fecal coliform, industrial effluents, and agricultural runoffs (Azizullah et al., 2011), however water quality parameters of WHO are constantly violated.

Insufficient water quantity and poor sanitation cause various waterborne diseases such as, diarrhea, malaria, intestinal worms, and typhoid etc. WWF (2007) reported that worldwide, an estimated 1.6 million DALYs (Disability Adjusted Life Years) are lost every year due to diarrheal diseases and around 900,000 due to typhoid. The bulk of this sum includes children affected by diarrhea and typhoid which explain the vulnerability of children of waterborne diseases. Due to the lack of effective preventive measure and control, the situation keeps getting worse. Rosemann (2005) reported that in Pakistan, diarrhea accounts for 14% of the illnesses in children under five years of age and 7% of people of age five and older. An estimated 0.2 to 0.25 million children in the country die due to waterborne diseases yet a number of hospital cases do not get recorded. According to World Health Organization, 13.6% of total deaths in Pakistan are due to water quality, sanitation, and hygiene issues.

Human activity is one of the major factors that effects the hydrology and quality of water. Unsustainable water consumption practices by agricultural, industrial, and domestic purposes impose immense stress on water resources. Large amounts of water are consumed by humans to sustain a standard living, however, Azizullah et al. (2011) describes that measures of sustainability

of the consumption practices is highly variable depending on how sustainability is interpreted. Effects of human activities on small scale extends through all of the drainage basin. The degradation of water quality in one region of the watershed can also cause effects to consumers downstream of that watershed. Peters & Meybeck (2000) mentioned that any substance added to the land, atmosphere or water take relatively longer time for removal. Effective resource management should recognize cyclic and cascading effects of human activities to study the water quality throughout the water pathway.

Water resources are polluted in a number of ways by humans; by direct dumping of solid waste near or in freshwater resources, releasing chemical and biological waste, and washing cars, clothes, or vessels in the freshwater. The absence of solid waste management systems in developing countries leads to open dumping of waste. Due to such prolonged conditions, it becomes a common habit of individuals to dump waste openly or near water resources. The unrelenting human pressures on environment and particularly on water resources continuously degrades the quality of freshwater, causing occurrence of waterborne diseases. Karanth et al., (2008) views that individual's behavior and attitude towards a particular problem are influenced by their beliefs. Examining people's attitudes is important to understand their response towards a potential management or environment policy and to create public awareness.

2.3 Theoretical Frameworks

Theoretical frameworks are important to provide a paradigm with which a better understanding of the scope of the topic can be achieved. For the purpose of this study, Norm activation model (Schwartz and Howard, 1981), Theory of reasoned actions (Ajzen and Fishbein, 1980), and Health belief frameworks (Janz and Becker, 1984) are adopted (shown in fig. 4). Frameworks help

identify the general elements that any theory relevant to a similar phenomenon needs to incorporate (Ostrom, 2011).

2.3.1 Norm Activation Model (NAM)

Popularized by Schwartz and Howard (1981), Norm Activation Model (hereafter NAM) explains prosocial behaviors and how prosocial behaviors are followed in response to personal norms (PN), reflecting ‘feelings of moral obligations to perform or refrain from specific actions’. Personal norms are self-expectations for a particular behavior which are derived from the values and norms concerning a specific behavior. When people are aware of the consequences (awareness of consequences, AC) of their actions towards others or the environment and when they believe that they have the power to reverse these consequences (ascription of responsibility, or AR beliefs), then personal norms are activated. Steg and Gifford (2008) explain AC as when people are aware of the negative consequences of their actions to the environment, or they see it as an opportunity to help reduce these effects, they are more likely to take it as their responsibility to take the right action (AR). However, when people are unaware of the consequences, they do not consider it a moral obligation to perform prosocial actions. The figure (1) below illustrates this relationship.

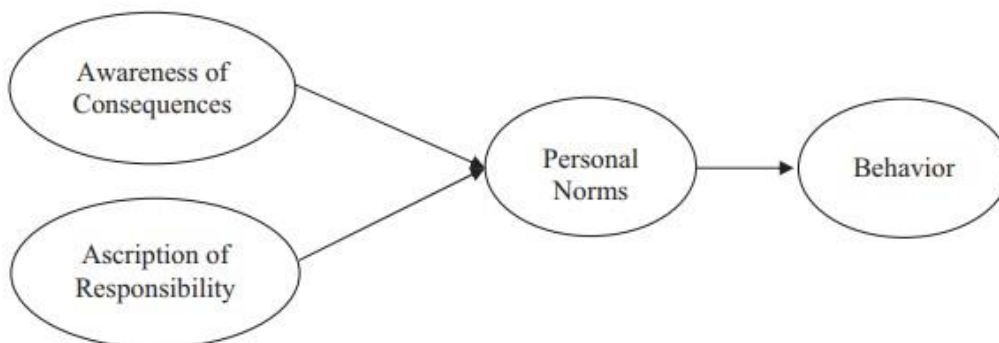


Figure 1 Norm Activation Model (Schwartz, 1977)

NAM primarily explains sacrificing one's interests for the wellbeing of others, thus, this involves altruistic behaviors related to concerns for others. The author continues by explaining the apparent effectiveness of NAM regarding environmental behavior in terms of low behavioral cost. The behavioral cost can be either in terms of money, time, or effort. This can be explained as, if an environmentally friendly behavior, involves more time, money or effort, a person may get more inclined to not adopt that behavior (Steg and Gifford, 2008). NAM is not effective in explaining environmental behavior when the behavior in question is more costly, which then cause people to neglect pro-environmental behaviors. Apparently, in such cases egoistic concerns prevail and personal norms are pushed in the background. Moreover, people are very creative in giving reasoning to their anti-environmental behavior because individual pro-environmental behavior will be taken for granted or will not be significantly influential. This defense mechanism of giving reasoning to anti-environmental behavior seems effective because environment as a whole is a complex system and individual contributions may not be fruitful because of the large scale of most environmental problems (such as tragedy of the commons). Authors (Steg and Gifford, 2008) also states that people not only act out of environmental concern, but ease, comfort, status, convenience, and safety also have a significant role in human decision making.

The implications of Norm Activation Model theory to a research study on water pollution relating to human mindset lies in the fact that personal norms shape human behaviors which may or may not result in pro-environmental behaviors. It is valuable knowledge to understand constraints and barriers to desirable behavior and the need for transformative thinking which can lead to pro-environmental behaviors.

Another relevance of the framework is that it provides structure to understanding the assertion of an individual's behavior towards water management and waste handling, which will indicate the

success or failure of the system and may recognize the factors that stipulate this behavior. Also, the framework indicates that awareness of the consequences and ascription of social and personal responsibility influence people's behaviors, as such if people are aware of the significant consequences of their actions, they are more likely to act responsibly.

2.3.2 Reasoned/Responsible Action Theory

Theory of reasoned/responsible action proposed by Ajzen and Fishbein (1980), stipulates that human behavior is grounded in the rational thoughts. The model predicts that attitudes reflect behaviors only under the condition that these two refer to the same resulting outcome. The theory explains that 'intention of acting' directly influences the behavior and can be predicted by attitudes. Subjective norms and beliefs shape these attitudes. The relative importance of these variables can be influenced by situational factors. Reasoned action theory rationalizes for the times when people have an intention to act responsibly but their actions are hindered by either due to lack of confidence or the perception that they do not have control over their behavior. Figure 2 is the graphical illustration of this relationship.

Furthermore, due to different kinds of experiences people form their belief system and also get motivated to act in a certain way, may or may not knowing the consequences of their belief and resulting behaviors. These beliefs then formulate the attitudes and subjective norms which have a direct impact on the intentions and the subsequent proceeding behavior. Subjective norms play an important role, as they are the beliefs of an individual that the members of society believe whether the individual should or should not take part in a certain behavior (Ajzen and Fishbein, 1980).

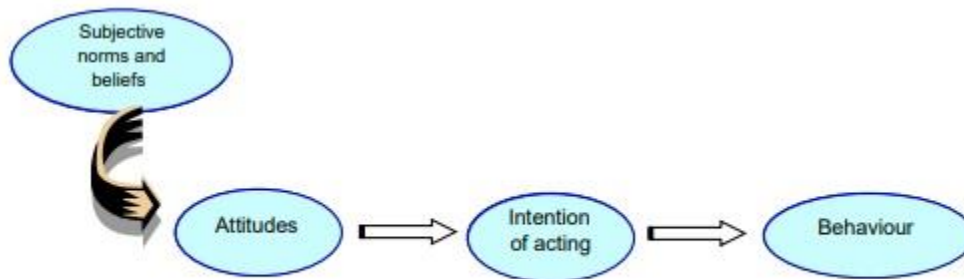


Figure 2 *Theory of Reasoned/Responsible Action (Ajzen and Fishbein 1980)*

This relationship may contribute to environmentally responsible attitudes when there is an intention to act responsibly for the relevant issues. However, if the competence is developed simultaneously, only then these intentions are turned into effective expression by specific actions. This theory is relevant to the study because it provides foundation to understand the reason why people do not act in environmentally responsible ways. With the fact that even when an individual has good intentions, still the lack of confidence or the feeling of lack of control over their behaviors can hinder in translating these good intentions into environmentally favorable actions. The implications of this theory to the study lies in the fact that subjective norms and attitudes can help shape the behavior. It is a beneficial knowledge to help explain which subjective norms and attitudes lead to the observed behavior of the population of study.

2.3.3 Health belief theory

An individual's beliefs help shape their behaviors. However, an individual's beliefs are not fixed characteristics, but they are acquired through primary socialization. The Health Belief model (shown in fig. 3) emphasizes on two aspects of how an individual views health and belief (Janz and Becker, 1984). These views involve threat perception and behavioral evaluation. Threat perception is built on an individual's perceived susceptibility to illness and the resulting severity of the symptoms. This theory states that whenever there is an increased risk for an individual, the

likelihood of them adopting a recommended preventive behavior also increases. Behavioral evaluation is built on the benefits that the adoption of a certain behavior will bring to a person. Behavior evaluation is linked with the availability of course of actions, that when followed will turn out to be beneficial (Rosenstock et al, 1990).

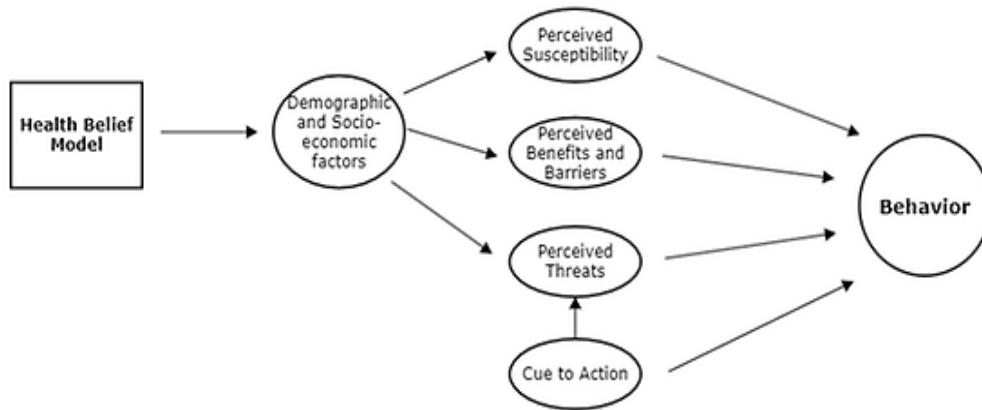


Figure 3 Health Belief Model (Janz and Becker, 1984)

Other than these two aspects, demographics, sociopsychological and ‘cues to action’ variables are important components too. Here, cues to actions is explained by Zak-Place and Stern (2004), as a stimulus that can trigger the desired healthy action. These cues of actions can be either in the form of an awareness campaign, illness of a relative or a reminder note by a doctor. The implication of this theory to our study is the cues of actions in terms of illnesses of the children and other family members as indicator to take environmental action.

Principles of this theory can be applied in our study to predict behavior change, particularly because this study interplays with health as a result of negative environmental practices that can cause incidence of diseases. Another relevance of the Health Belief theory is that if the fear of negative consequences of poor environmental behavior will propel the individuals to adopt pro-environmental behavior prevails or not. As pro-environmental behavior is an amalgamation of

personal interest, concern for people, next generations and the ecosystems, this theory can help provide basis for a substantial understanding of the cause and action.

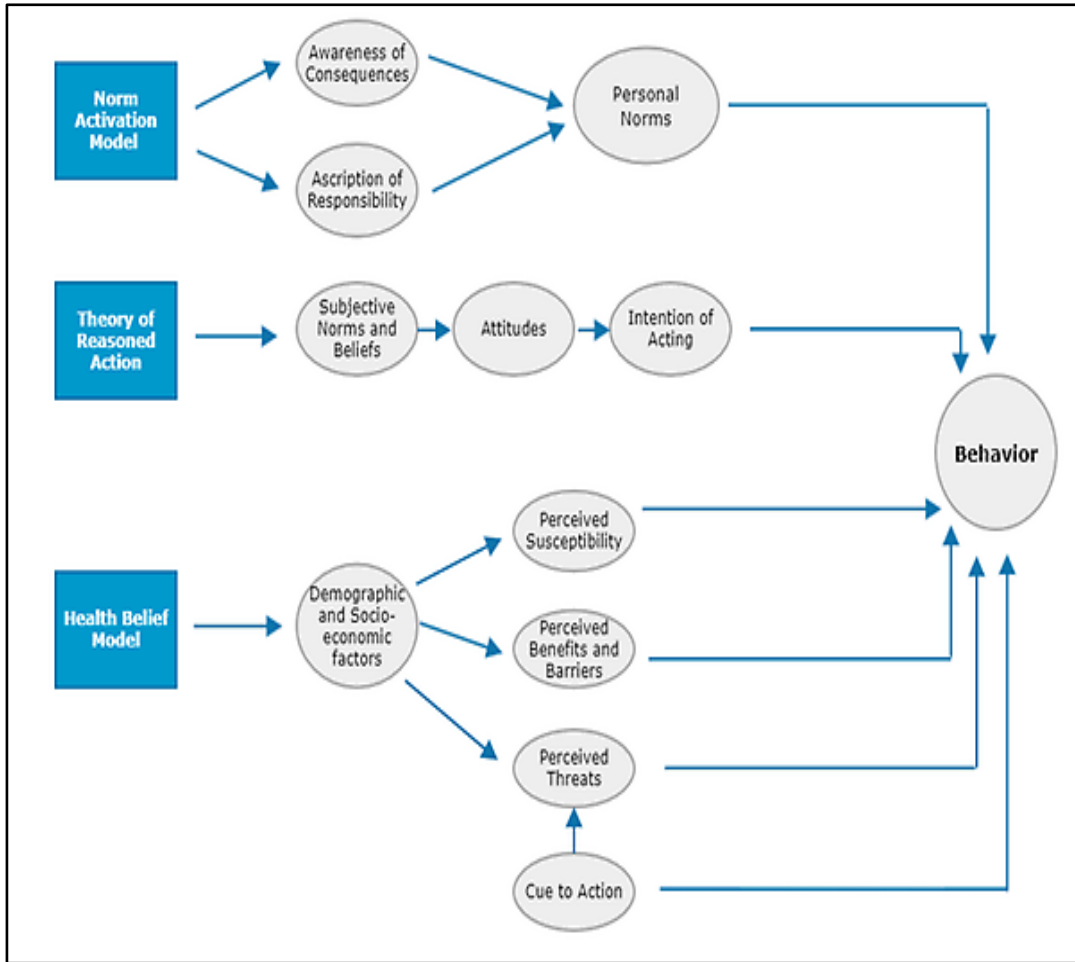


Figure 4 Theoretical Framework for the study

CHAPTER 3: RESEARCH METHODOLOGY

3.1 Overview of methodology

This chapter deals with the research methodology acquired for data collection and data analysis. It covers the research design, underlying philosophy and a description of the population of study. The adopted sampling technique and sample size are presented with the reason for sampling. The processes and designated instruments for data collection are also presented. In addition to this, validity and reliability of the collected data and the related ethical compliance measures are discussed.

This study employed mixed methods research methodology, which is a process of collection and analyses of data by integrating both qualitative and quantitative methods in a single study (Bryman, 2016, p.635). As stated by Hughes and Sharrock (1997), the use of quantitative methods depends on the need to collect measurable information on a phenomenon from different respondents. The choice of qualitative method was based on the need to explore the subjective perception of various respondents, regarding constraints on improvement of water quality management. The combination of these two methods helps elaborate the phenomenon of interest. The mixed methods research leads to greater validity, providing a better understanding of the information gathered and broader explanation of the general study.

The choice of quantitative methods is informed by the purpose of the study and the underlying research objectives. Information from respondents was collected through household survey in the field. These households were selected through systematic sampling (Bryman, 2016, p.178). A multi-part questionnaire covering the research questions served as a data collection instrument. The choice of qualitative method was based on the need to review the human dimensions on water

quality issues and constraints that human attitude puts on water management practices. An interview schedule was formed to elicit this objective. The respondents for qualitative interviews were selected through purposive sampling (Bryman, 2016, p.408).

3.2 Research design

The success of a research is based on how well the chosen research design fits with the objectives and purpose of the study. A research design gives a framework for data collection and analysis (Bryman, 2016, p.40). It refers to the entire study process, from conceptualizing the research problem to data collection, analysis and describing the findings (Magilvy and Thomas, 2009). This study adopted the cross-sectional research design, which entails collection of data from a number of cases that are representative of the population of study, gathered at a single point in time. This gives the possibility of analyzing relationship between various variables of interest (Bryman, 2016, p.53). Some of the variables for this study include level of education, drinking water treatment, perceived quality of drinking water, and polluting surface water sources.

The research design followed is termed ‘explanatory sequential design’, which involves the collection of data quantitatively followed by qualitative data collection, that in a way explains the quantitative analysis (Bryman, 2016, p.640). For this study, it was essential to follow this design to find answers to the research questions under consideration.

3.3 Study area and population of study

This study was employed in Gahkuch town, Gilgit-Baltistan (Figure 5) which is in the northern part of Pakistan. Gahkuch is located 72 kilometers northwest of Gilgit. Its geographical location lies between 36°09' N to 36°14' N and 73°42' E to 73°49' E at an altitude of 7500 meters above sea level. The population of this town is 12,500 in 1704 households as of May 2019 (District Health

Office, 2019). Gilgit river passes by this town and people use water from this river for household purposes. Other than that, drinking sources for the household and commercial purposes is provided from the streams. Due to the recent increase in population in this town, the generation of waste has been increasing and dumping of waste near and into the river and streams channels by households has increased. Moreover, the hospital drainage, carwash and washing of clothes near the river and stream channel is potentially contributing to water pollution. The quality of water in this area is deteriorating due to chemical, biological, and solid waste dumping, which potentially cause serious health effects to the population in question.

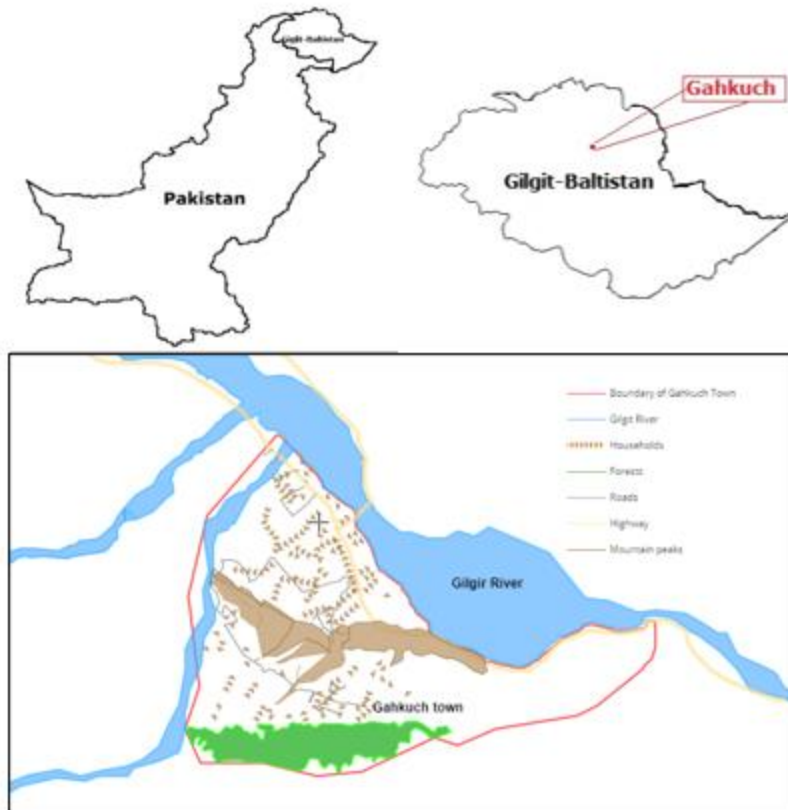


Figure 5 Map of study area; Gahkuch, Gilgit-Baltistan

3.4 Sampling procedure and sample size

For the selection of a representative sample of population and enhancing validity of the research, a sampling procedure needs to be followed. The sampling procedure employed for this study was systematic random sampling. This involves selection of samples in a systematic manner through calculating the interval by dividing the population size with the desired sample size. The resulting value would be the sampling interval or a fixed interval (Bryman, 2016, p.178). Following this procedure, the first sample is randomly selected, and every corresponding sample is selected after a gap of calculated sampling interval. For this study, the sample interval calculated was eight, which meant that the first household from each direction - north, south, east, and west - was selected randomly and after that every eighth household was surveyed.

$$\text{Sample Interval} = \frac{\text{Population Size}}{\text{Desired Sample Size}}$$

$$\text{Sample Interval} = \frac{1704}{200}$$

$$\text{Sample Interval} = 8.5 \cong \mathbf{8}$$

For the qualitative part of the study, 6 interviews were conducted, and the interviewees were selected based on purposive sampling (Bryman, 2016, p.408). Purposive sampling entails the selection of samples in a strategic way, so that the respondents are relevant to the research questions under consideration.

3.5 Data collection

For this study, the data was collected through questionnaires and interviews. Questionnaires and interviews are survey research tools and assist in gathering multiple opinions from a sample

population. Self-administered questionnaire was formulated to ensure an adequate percentage response rate. From each selected household, a questionnaire survey was conducted, consisting of 27 questions. The questionnaire was formulated in English but was translated and respondents were assisted by the researcher in their local language in filling up the questionnaire. Survey was conducted from 200 households selected through systematic random sampling and 6 respondents were selected by purposive sampling for qualitative interview. The return rate for survey questionnaire was 100% because respondent households were administered by the surveyor and a face-to-face questionnaire survey was filled. Response rate was considered ideal for the analysis of the data collected.

The questionnaire survey was constructed keeping in view 'WHO and UNICEF core questionnaire' and 'Case questionnaire' formats as data collection tool to find out the drinking water and sanitation conditions and risk of poor-quality water on health of targeted population (World Health Organization and UNICEF, 2006). The questionnaire was designed to gather information on demographics, educational and socioeconomic status, hygiene, sanitary conditions, health problems, their attitudes, and perceptions towards water quality issues. While visiting the study areas, contamination sources, hygiene conditions, occurrence of open waste disposal were also observed.

To study the barriers and enablers for improvement of water quality and need for transformative thinking in the study area, interviews were conducted from key informants to help identify the present constraints on treatment of drinking water. The future potentials for improvement of drinking water in terms of protection from contamination and changing human behavior by awareness of targeted population were also included in interview questions.

3.6 Data analysis

Data analysis is the most important aspect of research study which is the process of uncovering the trends and patterns in the collected data and dispensing interpretations which are in line with the research objectives. Descriptive statistics was utilized, for the purpose of this study. Descriptive statistics are the most elementary methods for quantitative data analysis. This is used to lessen the complexity of data and form a structure out of the voluminous data from which patterns can be determined (Bond and Fox, 2007). Descriptive statistics such as, mean, mode, frequency counts, percentages and linear correlation were applied to measure the responses and relation of waste disposal, water quality and mindset of people.

The perceptions of respondents need to be grouped based on similarities and differences (Kumar, 2005). For every variable studied, different responses were coded with numerals (1,2,3...5). These numerals served the purpose of coding the responses into the statistics software SPSS for data analysis. After this purpose, the required analyses were run for each variable studied.

As a descriptive statistic tool, the mean of some variable such as the constraints and possible options for management were calculated by comparing the mean to the midpoint mean. The result for each variable was considered significant when the mean value was higher than the midpoint mean value, and vice versa. This indicates that any variable whose mean value was greater than 3 was considered *significant* while variables with mean value less than 3 were considered *not-significant*.

To calculate the midpoint mean, the responses were scaled i.e. Strongly Agree = 5, Agree = 4, Neutral = 3, Disagree = 2 and Strongly Disagree = 1.

Midpoint Mean = Total sum of response scale/number of responses

$$\text{Midpoint Mean} = \frac{5 + 4 + 3 + 2 + 1}{5} = 3$$

3.7 Validity and reliability of data collected

Validity and reliability are measures which ensure that whether the data collection tools reflect the research questions and objectives, or some revision is required. Validity is “referring to credibility of a description, explanation, interpretation and conclusion of the research” (Maxwell, 2012, p.122). The questionnaire and interview questions were devised with guidelines from WHO and UNICEF questionnaires while review of literature also served as a measure to ensure validity and reliability. The questionnaire used as a data collection instrument was at first tested for its validity and reliability and a pilot survey was conducted before deployment to the field. The pilot survey helped to gauge the responses for relevance to the study and provided feedback for finalizing the questionnaire. This test measured the ease of use of the questionnaire by the respondents in terms of clarity, understandability, and comprehensiveness.

3.8 Ethical compliance

According to Saunders et al (2016), ‘the nature of the research, the selection of participants, information usage and storage, guaranteeing anonymity of participants and the effects of the study are issues that must be addressed from the ethical perspective’. Considering the information gathered through this research, I responsibly as a researcher informed all participants about the need and use of data collected through questionnaires was merely for the research purposes. I explained them about my research and took their verbal consent before taking the survey. Similar

ethics were followed for the recording of qualitative interviews. It was also informed to them that the participation in the survey was completely voluntary and the data contained will be processed anonymously. They were also acknowledged that they can at any stage of this research elect to be disconnected from the study.

3.9 Limitations and Challenges of the study

This study is limited to the data collected through questionnaires and semi-structured interviews and to existing literature on water quality management. People in Pakistan are usually politically oriented. Sometimes they are reluctant to speak because they think that government will collect this information and use it against them or will impose restriction on them. I found that some people were hesitant to talk because they thought it was some kind of test and with their limited knowledge they might not be able to answer the questions. Some of the respondent's answers may have contributed to bias because sometimes people answer what they think is expected or wanted from them. Generally, people were welcoming but sometimes some of the female respondents were distracted by their chores, making it difficult to get their attention back on the questionnaire.

There were some challenges that I faced during my travel to the study area. Gilgit is a mountainous region and the roads are narrow and two-way. Due to limited time for research, I had to travel in summer and it was a rainy season. Occurrence of landslides is very phenomena in that time of the year and I had to be stuck on road for 9 hours due to one such landslide. However, despite all these challenges I was able to collect data for this study.

CHAPTER 4: RESULTS AND DISCUSSION

This chapter presents results from the fieldwork and discusses the findings. The results are based on both quantitative and qualitative data collection. The first section (Part A) of this chapter includes analysis of the demographics and perceptions of the study population. Second section (Part B) includes analysis and interpretation of the qualitative interviews and mainly focuses on the attitudes, behaviors, and mindset of people that cause barriers in improvement of water management. Furthermore, secondary data is included to support and enrich the findings and to better describe the existing perceptions.

4.1 PART A: Questionnaire Analysis and Interpretation

4.1.1 Section A: Demographic characteristics of respondents

The number of respondents was determined before the fieldwork and the goal was to reach 200 households. Out of 200 representative respondents of a household, 128 were males and 72 were females.

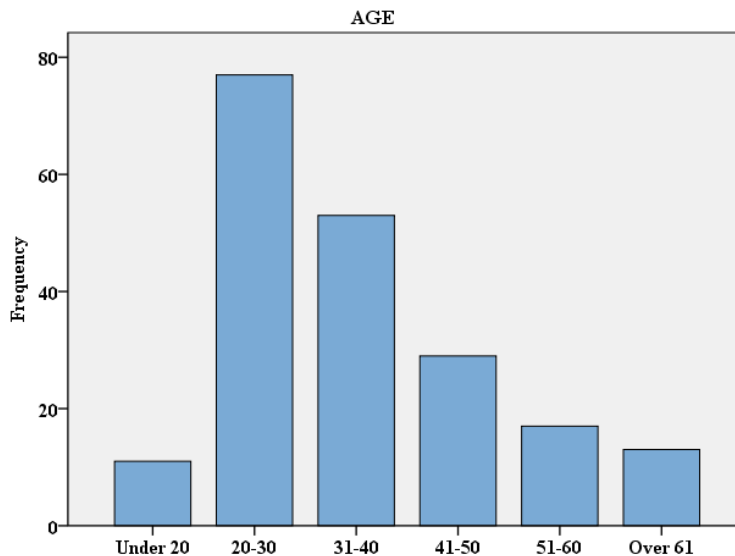


Figure 6 Age of Respondents

The above figure (6) represents the age of respondents, categorized in six groups. There were 11 respondents under the age of 20 which makes only 5.5% of the total respondents. Most respondents (77) were aged between 20 to 30, representing 38.5% of total respondents, while 26.5% respondents were aged between 31 to 40.

The figure 7 below shows demographics in terms of level of education of respondents. The majority of respondents at 23.5% have had intermediate level of education, which accounts for 47 responses. Second highest responses falling at 19.5% had studied bachelors, while very close to that, 18% respondents reported illiteracy making it the third highest representation by 36 respondents.

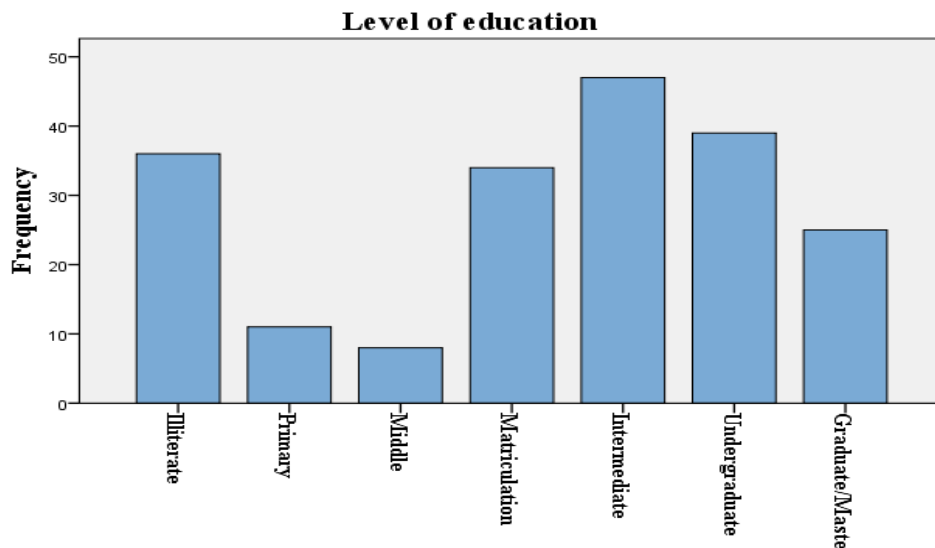


Figure 14 Education of Respondents

The minority representation in this category is made up by those who studied at middle school level, making it only 4% of the responses. The level of education attained by the respondents are questioned for whether or not the education levels determine the behavioral tendencies of population towards water quality management. A study by Alam (2017), showed that an environmental education (EE) and awareness intervention conducted over a period of six months

in a secondary school in Gilgit city resulted in active involvement of students, teachers, and community members in sustainable environmental practices and positive attitude towards environmental management.

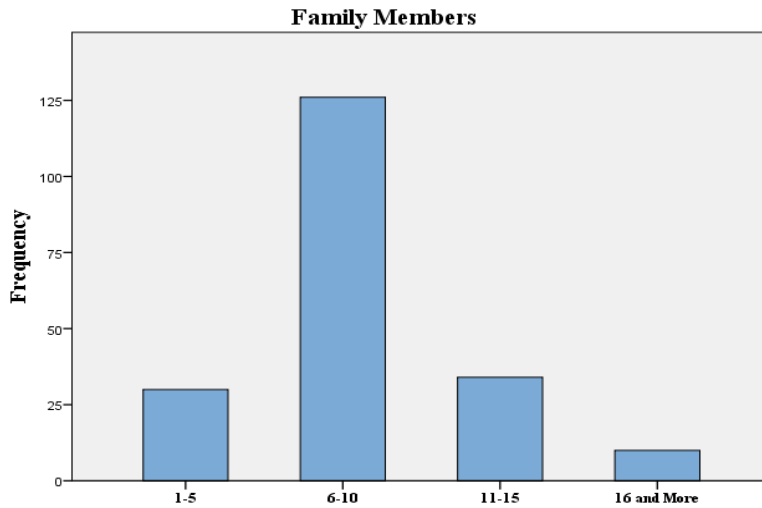


Figure 8 Number of Family Members per Household

The figure 8 illustrates number of family members per household. The graph shows the highest representation at 63% which falls at 126 out of 200 households having family members between 6 to 10. While, 17% respondent household had family members between 11-15, represented by 34 households. Whereas, only 15% of responses account for the 1-5 members category. This demographic category was studied to estimate the population distribution per household. It can be learned from this observation that the households in the study area have relatively larger family sizes, resulting in population growth.

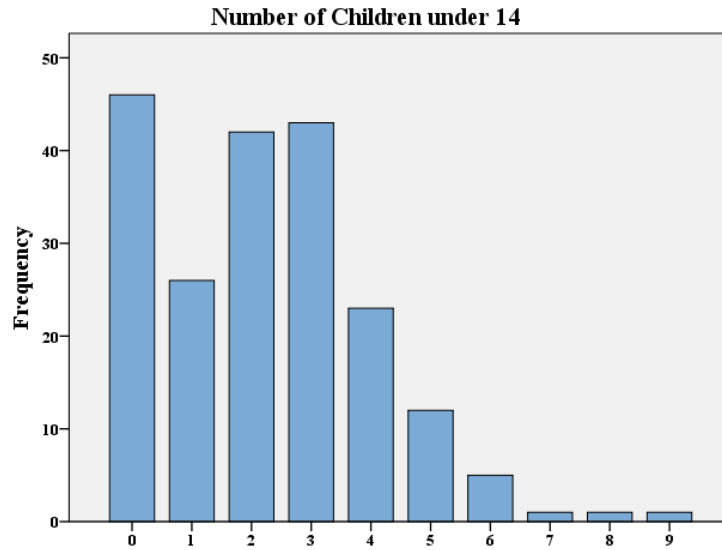


Figure 9 Number of Children per Household

The last category studied under the demographic characteristics of the population was number of children under the age of 14 per household. Figure 9 shows that 46 of the respondent households do not have any children under the age of 14, making it to 23% of the responses. 42 and 43 of the respondent households had 2 and 3 children respectively, making it to 21% and 21.5%. While 3 of the households reported 7,8, and 9 children per household, respectively.

4.1.2 Primary water quality and management

This section intends to address the objective of studying human perspectives of water quality management and human health effects relevant to degraded drinking water quality in Gahkuch town, Gilgit-Baltistan.

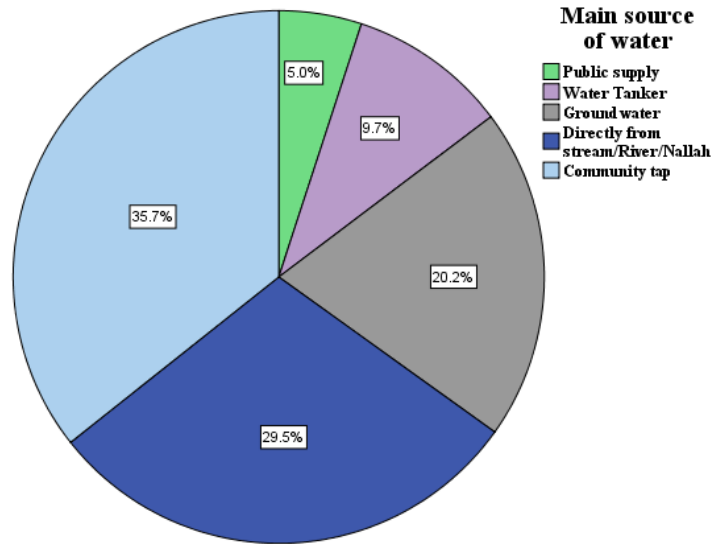


Figure 10 Main sources of Water Supply to Households

Since, the study area does not have a single government regulated water supply system, there are several sources of water supply opted by the community for their household water usage. Figure 10 represents the distribution of main water source among the population under study. 35.7% of the respondent households get water for their consumption from the community tap, while 29.5% respondent households get water directly from either stream, river, or spring. This shows a substantial number of people are consuming degraded quality water as demonstrated by several water quality assessment studies conducted in Gilgit (Ali et al., 2014; Begum et al., 2014; Daud et al., 2017 and Sohail et al., 2019). Therefore, the population under study is subject to various water-borne health effects. Ground water is the primary water source for 20.2% of the respondents while, only 5% of them receive water from public supply systems.

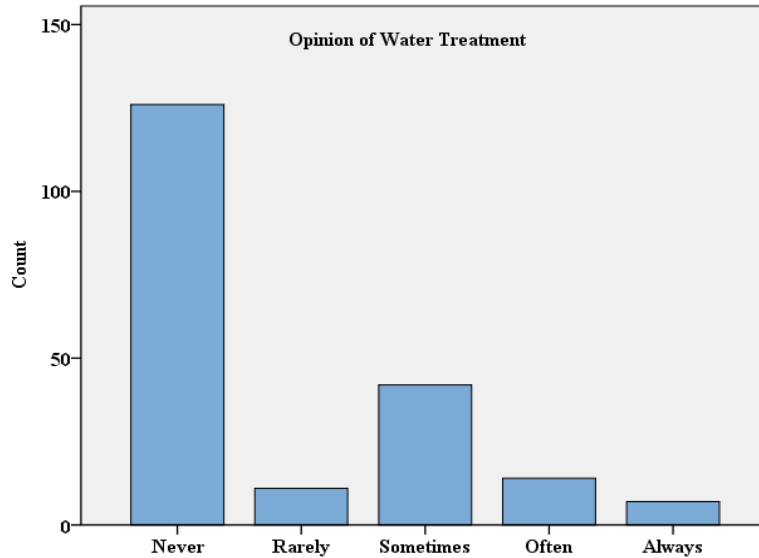


Figure 11 How often is water treated before consumption?

The results on views and perceptions related to water quality will help to elaborate people’s understanding of water pollution and the need to change their attitudes. The figure 4.6 indicates that 63% of the respondent households, which is 126 out of 200 never treat water in any way before consumption. 21% responses treat water sometimes while 7% treat the water often before consumption. The fig. 11 show that only 3.5% respondent households, which is 7 out of 200 always treat water before usage. These statistics represent that even though the water is consumed mainly from the streams and community tap, people still do not apply any household water treatment prior to consumption.

Water assessment report by Gilgit-Baltistan Environmental Protection Agency (GB-EPA, 2019) from towns in the province showed that 78% of water sources fall in the categories of low to high risk for human consumption, while only 22% of the sources comply with WHO standards of drinking water quality.

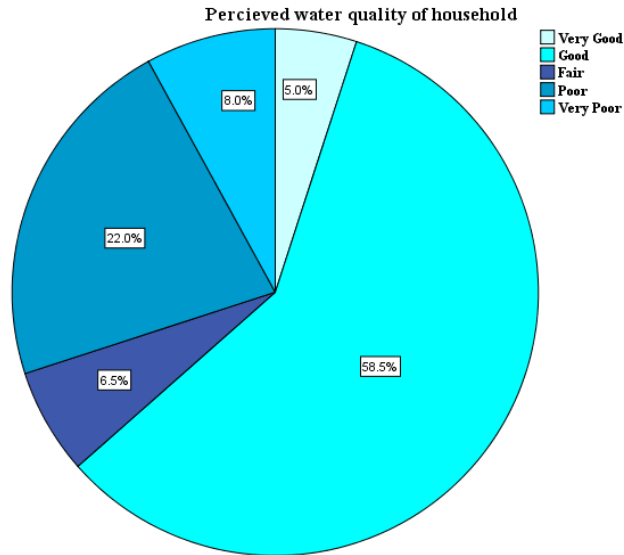


Figure 242 *Perceived Quality of Drinking Water by the Respondents*

The figure 12 represents the perceptions of population under study related to how they perceive the quality of water that they are consuming. It illustrates that 58.5% of the respondents perceive the water quality of their household as ‘good’ which falls at 117 out of 200 responses. While only 10 of the respondents, making 5% of the total, perceive that the quality of water they consume ranks at ‘very good’. The 22% of the respondents perceive the water quality to be ‘poor’ while 8% of the responses showed the water quality was perceived to be ‘very poor’. As majority of the respondents perceive the water quality to be either good or very good, it contradicts with the actual water quality state of the surface water sources of the study area as presented in a report by PCRWR (2016). The report shows that 100% of the tested water samples from multiple locations in Gilgit had bacterial contamination and unfit for human consumption. Since the area has a rocky topography, the surface water sources present accumulation of metals such as, Boron (B) and Manganese (Mn) above permissible limits (GB-EPA, 2019).

As stated by House (1996), people generally judge water quality by its aesthetic appearance, be it its color, taste, and odor. The perceptions of local population that the quality of water they consume is good, is majorly because the water from springs flows in a crystal-clear state. As reported by GB-EPA (2019), similar status exists in the study area where water flowing from the springs visibly appears crystal-clear but 78% of the tested samples showed low to high risks for human health.

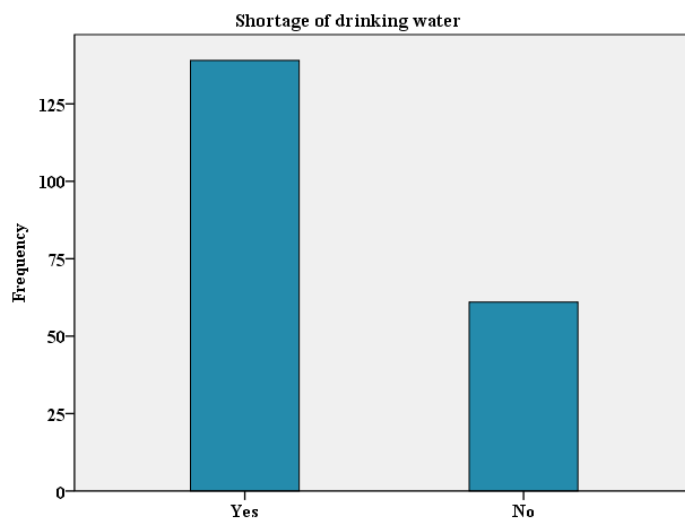


Figure 13 Shortage of water faced by the population

The next parameter studied was about the shortage of drinking water faced by the citizens. Evidently, as shown in figure 13, 139 out of 200 respondent households experience shortage of water on regular basis, making it to 69.5% of the sample, while 30.5% responses did not experience water shortages. These digits show that even though this population has a couple of water sources, they still face shortages of quality water for their consumption. These results align with those presented in Pakistan Council of Research in Water Resources report, which shows that due to the rocky strata of this area access to ground water is extremely difficult. Therefore, glacier and snow melting are likely the main sources of water. In winter due to reduced snow melting water supply

reduces even more, causing water shortage for the population residing in these areas (PCRWR, 2015).

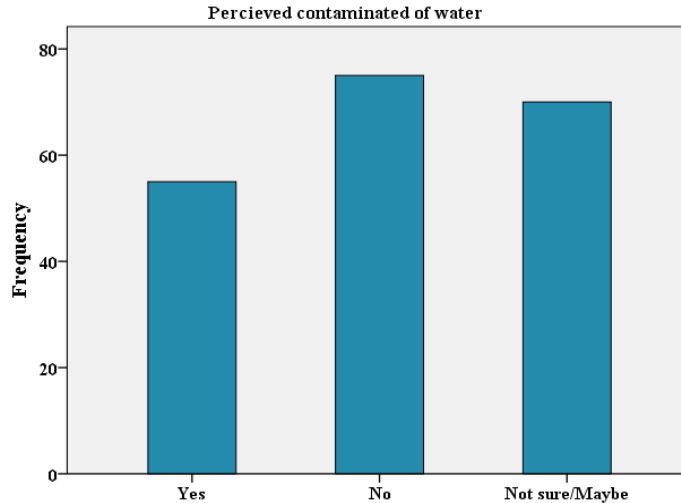


Figure 14 *Perceived Contamination of Drinking Water by the Respondents*

The figure 14 showed that if the population under study perceive that the water they consume is contaminated with waste material or not. Most of the respondents (75 out of 200) think that the water is not contaminated with any waste material, representing 37.5% of the responses. 55 out of 200 respondents representing 27.5%, perceive the water they consume to be contaminated while, 70 out of 200, making 35% respondents were uncertain and thought maybe the water is contaminated. These results indicate a variation of view among the population that majority of the respondents are either uncertain about the quality of their water supply or they perceive it to be contaminated with waste materials.

These perceptions possibly stem from the lack of information and awareness among the population about the water quality of the area. Since the general public do not have access to scientific information about the quality of water they consume, they can rely on the myth of spring water being the purest form of naturally occurring water source. Another possible reason behind these

perceptions could be that the people distinctly regard water as contaminated only when it is turbid or has some odor. However, aesthetic characteristics do not have any relation to the physico-chemical composition of the water (House, 1996).

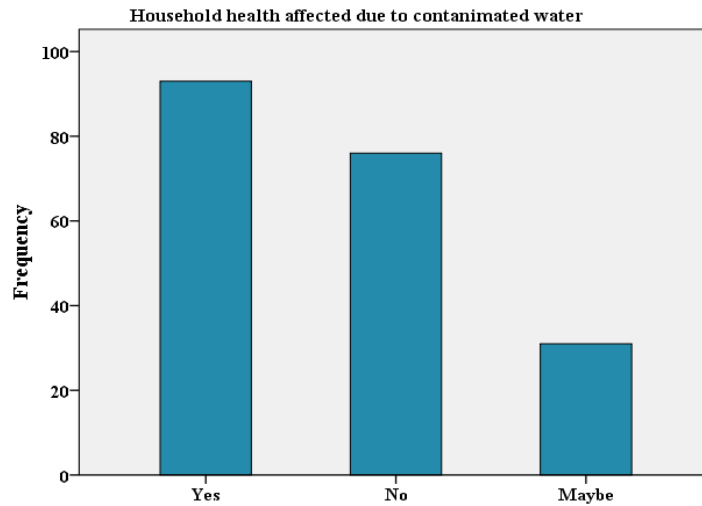


Figure 15 Health of Household Effected due to Water Contamination

The next aspect studied was if the degraded quality drinking water causes health effects in the households of the respondents. The figure 15 shows that enough though some people are either uncertain about the quality of water or perceive it to be uncontaminated, they still face health effects due to water-borne diseases. 93 out of 200 respondent households making it to 46.5% evidently shows that their family members face health issues due to consumption of degraded quality water. 38% of the results represent that they are not affected by the contaminated water while 31 out of 200 (15.5%) responses show that the respondents are uncertain about the effects. This perception can be explained in relation to Health Belief theory (Janz and Becker, 1984) which states that people's behaviors are driven by their threat perception. Since our results show that around 53.5% respondents do not perceive contaminated water to cause any risk to their household's health, it is less likely for them to adopt preventive behavior.

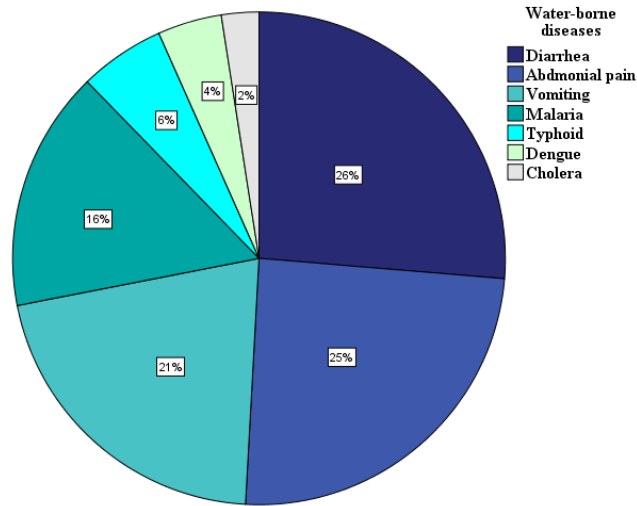


Figure 16 Common Water-borne Diseases of the Respondents

The figure 16 illustrates the occurrence of water-borne diseases in the study population. Majority of the respondents mentioned the incidence of more than one water-borne disease. The above graph represents the cumulative percentages for the incidences. The 26% of the responses reported that their families have been affected by diarrhea, while 25% responses have experienced abdominal pain. The 21% respondent households have suffered from vomiting and 16% have been ill due to malaria. Typhoid, dengue fever and cholera were reported by 6%, 4%, and 2% of the households, respectively. However, 25.5% of the respondents reported that they do not have access to the required healthcare services (Appendix 3).

The spread of waterborne diseases is not only the issue of this area but as highlighted in literature review, whole country experiences health related problems due to water quality issues (Rosemann, 2005). In a study by Nabeela et al., (2014), a review of microbial contamination of multiple drinking water sources throughout the country, was presented. This issue is not only due to the lack of knowledge among people about water quality problems but also involves the major issue of access to safe drinking water throughout the country (PCRWR, 2019). The increased incidences

of waterborne diseases in the respondent population could also be because of low level of public awareness about household water treatment methods. It was also observed in our study that 68% of respondent households do not boil water before drinking while only 21% of respondents sometimes boil water before consumption (Appendix 4). These results align with the study by Saleem and Salman, (2011), which reported that low-cost household water treatment methods such as boiling, filtration, disinfection are widely accessible in the country but rarely adopted.

Even though, through the analysis of above parameters, it was shown that a significant number of respondents do not perceive that degraded quality water cause health effects. However, a substantial number of respondents reported the above-mentioned water-borne diseases to commonly occur in their households. It can be learned from this observation that a significant number of people in the study area are not aware of water quality issue being the cause of their health problems. These findings make it necessary to initiate an awareness campaign as a ‘cue to action’, explained by Zak-Place and Stern (2004), that could result in change of perception of water quality risks. If households would be aware of the health effects caused due to contamination of drinking water sources, they would possibly act more responsible towards managing these sources and taking informed actions.

The recent water assessment report of Gilgit-Baltistan Environmental Protection Agency (GB-EPA, 2019), indicated absence of effective sewerage system in the district. This facilitates the direct release of sewage waste and waste effluents into the surface water sources from where the drinking water is sourced. This finding made it necessary to study what type of toilets are present in the households of the study area.

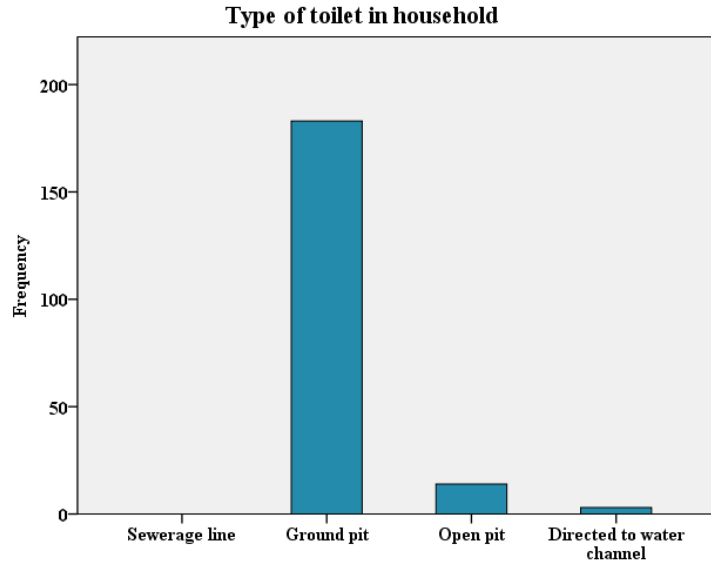


Figure 17 Type of Toilet in the Household of the Respondents

The figure 17 correspond with the report of Gilgit-Baltistan Environmental Protection Agency, showing that none of the households in the study area have access to toilets build on sewerage line system. 3 out of 200 households reported to have directed their toilet waste to the water channel. 7% of the responses reported to have open pit toilets in their houses while majority of the respondents falling at 183 out of 200, making it to 91.5% have ground pit toilets in their households.

A study by Uddin et al., (2014) reported that there are a number of drawbacks of pit toilets which include spread of diseases, security issues for children and women, the complexity for emptying the ground pit when it gets filled, short life cycle of pit toilets, pollution of surface and ground water sources. The study population is also vulnerable to these potential risks.

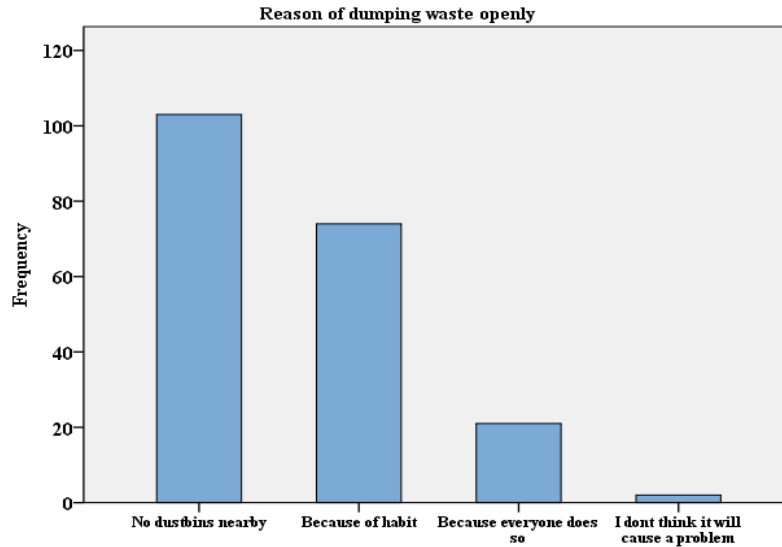


Figure 18 Reasons for Open Dumping of Household Waste Materials

As 44% of the responses showed that piles of solid waste are normally found outside their houses, it was made essential to study the reasons behind this common attitude of waste dumping in the study area. The figure 18 illustrates the few reasons due to which people openly dump waste materials. 103 out of 200 respondents, making it to 51.5%, reported that the absence of accessible trashcans in the main reason that they dump waste openly. 74 out of 200 respondents said that they throw waste because of a habit, while 21 out of 200 claimed that they do it because everyone does the same. This shows that around 47.5% of the respondent population represent waste dumping practice as a social norm in the study area.

These findings can be explained in relation to Reasoned Action Theory (Ajzen and Fishbein, 1980), that certain experiences drive people to form beliefs and act in a particular way. They may or may not know the consequences of their actions. When open dumping of waste becomes a subjective norm in an area, it becomes a common behavior of the people out of ignorance. This could also be due to other external factors, such as, lack of access to relevant knowledge (Levine and Strube, 2012) and ineffective environmental legislation (Azizullah et al., 2011).

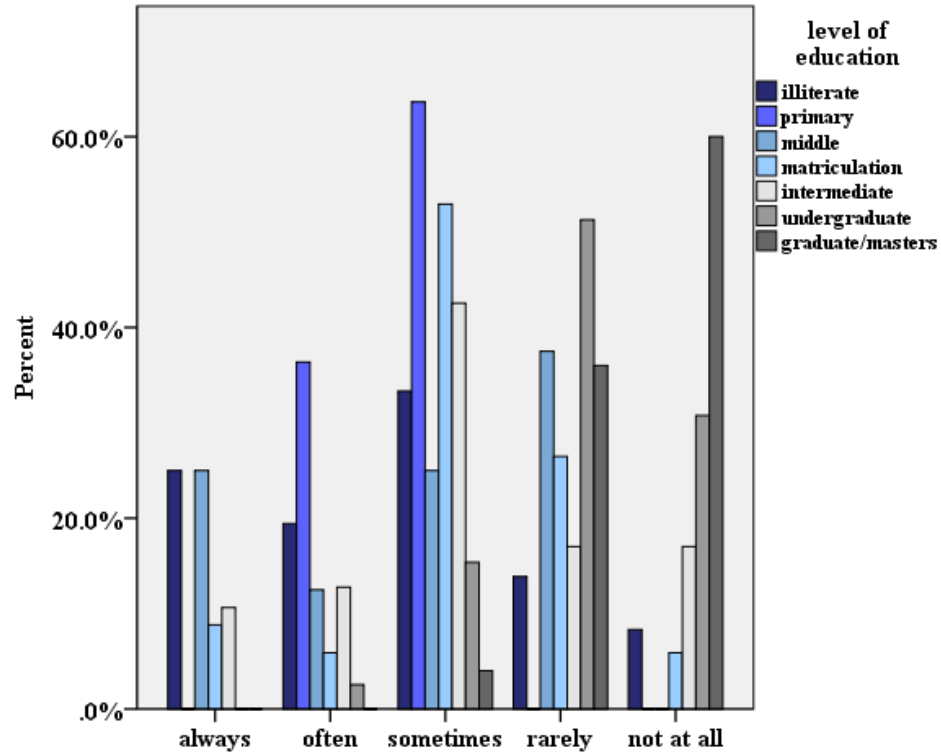


Figure 19 Correlation of Level of Education with Waste Dumping Practice

When comparing the level of education with how often the already existing waste influences the study participants to dump waste openly, a correlation presented in the figure 19 was depicted. This graph shows that people with no education to people with education to intermediate level responded that they sometimes throw waste materials openly. It can be observed from the illustration that very few people with no education and with only primary and middle level education responded that they do not practice this behavior. Moreover, the respondents with highest levels of education i.e. bachelors and masters, showed more responses for that they either rarely or not at all dump waste openly.

A study by Khalid et al. (2018) conducted in district Vehari, Punjab showed similar results, which confirmed that education and income strongly influence a person’s motivation to pollute water sources and adoption of water methods. However, it cannot be generalized that with the increase in level of education, the waste dumping behavior gets restricted. The reason being that the access

to knowledge and information relating to environment and health is not only limited to formal educational institutional settings. Effective environmental interventions not only focus on students, but also the whole community to influence attitude change resulting in environmentally friendly behavior (Levine and Strube, 2012).

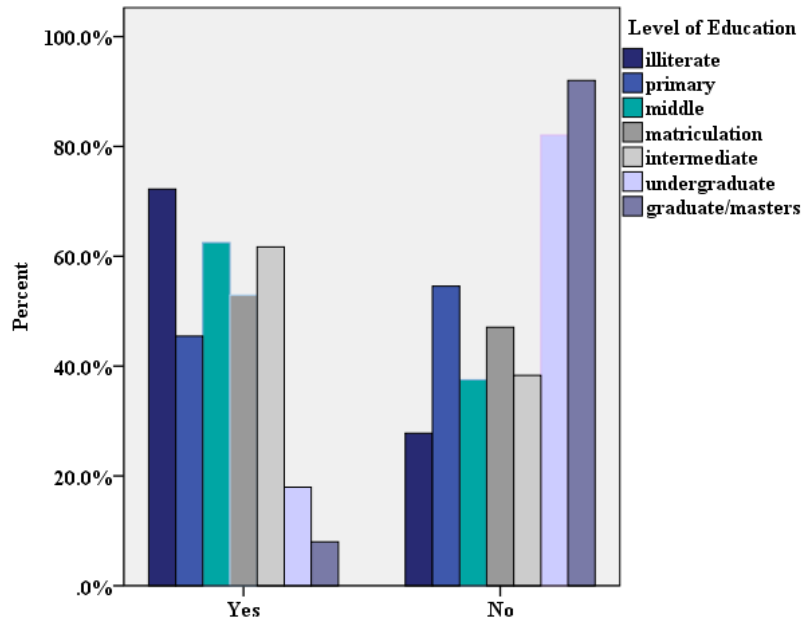


Figure 20 Correlation of Level of Education with the Practice of Polluting Water Sources

The next relation as presented in the figure 20 shows that does level of education depicts any relationship with the practice of polluting water resources. A significant correlation can be observed in the above figure that the highest positive responses of waste dumping behavior in water resources was exhibited by illiterate respondents and then by the people with low level of education, i.e. primary, middle and matriculation. People with higher education, such as, bachelors and masters responded as a rejection to such behavior. This correlation shows that the high level of education makes people aware of the consequences of polluting water resources and makes them responsible towards their actions. These findings can be explained in relation to Reasoned

Action Theory (Ajzen and Fishbein, 1980), that when people develop the ability to rationalize a situation, they develop intentions to act responsibly and in a way that is ethically right.

Table 1 Constraints on Water Quality Management

S/N	Constraints	SA	A	N	D	SD	Mean(X)	STD
1.	Insufficient waste collection points	53	106	24	16	1	3.97	0.86
2.	Far distance to collection points	43	120	29	3	5	3.96	0.80
3.	Lack of public water supply systems	78	108	12	2	0	4.31	0.62
4.	Lack of private companies	120	71	2	3	4	4.50	0.77
5.	Lack of treatment technology	136	56	3	1	4	4.59	0.73

Note: SA denotes Strongly Agree, A denotes Agree, N denotes Neutral, D denotes Disagree, SD Strongly Disagree

Source: Author's survey, 2020

The table (2) above shows the respondent's opinions on the significance of some of the pre-determined constraints on water management by the local residents on the study area. All the constraints are found to be significant as the mean value (X) of all the recorded constraints is higher than the midpoint mean (3). Insufficient waste collection points (X=3.97) and Far distance to collection points (X=3.96) were the constraints identified by the respondents. This finding aligns with an earlier one by Hussain et al. (2016), which presents that due to the improper municipal solid waste collection system a number of environmental problems had become common in Gilgit city. However, in a qualitative interview for this study, an official of newly established Waste Management Department in Gahkuch, reported that an initiative is under development for door to

door collection of household waste. Also, it can be observed in the figure 21 that municipal solid waste is being openly dumped and burnt near the river that flows through the town.

Lack of private companies ($X=4.50$) and lack of treatment technology (4.59) were evidently identified as the most significant constraints. Plappally and Lienhard (2013), showed in their study that this lack is mainly due to the concerns of cost and access. Water treatment technology is highly dependent on the funding, which developing countries are majorly unable to support.



Figure 37 Municipal Solid Waste Dumped near the River

Table 2 Social, Technological and Economic Constraints

S/N	Constraints	SA	A	N	D	SD	Mean(X)	STD
1.	Waste management is perceived as a dirty profession	44	82	9	43	22	3.41	1.33
2.	Low funding of water management operations	53	99	43	5	0	4.00	0.76
3.	Inadequate technical know-how	64	109	21	6	0	4.15	0.72
4.	Poor water quality legislation	69	111	17	2	1	4.22	0.68

5.	Costly water treatment technology	68	90	30	12	0	4.07	0.85
6.	Restricted access to treated water	61	93	28	1	1	3.98	0.91
7.	Low level of public awareness	57	121	16	6	0	4.14	0.68

Note: SA denotes Strongly Agree, A denotes Agree, N denotes Neutral, D denotes Disagree, SD Strongly Disagree

Source: Author's survey, 2020

The above table (3) represents that the pre-identified social, technological, and economic constraints on water quality management are significant. Inadequate technical know-how, low funding of water management operations, and costly water treatment technology were quite significant at means of 4.15, 4.00, and 4.07, respectively. Advanced management techniques often require specialist knowledge and high economic input, which is not always available in this part of the world. Water treatment becomes rigorous, energy intensive and expensive (Plappally and Lienhard, 2013). Poor water quality legislation is also an important constraint with the highest significance at the mean of 4.22. It is evident from the fact that the first meeting of Pakistan Environmental Protection Council (PEPC) was held 10 years after the council's establishment. National Drinking Water policy was approved in 2009 and after that a number of policies and acts have been formulated occasionally but no clear strategy has been executed (Azizullah et al., 2011).

The low level of public awareness ($X=4.14$) is also a significant constraint on the improvement of water quality management. The field survey revealed that people are not well aware of the health effects that are caused due to pollution of drinking water sources. Public awareness plays an important role in adoption of preventive measures and in influencing pro-environmental behaviors. To aware people about the link between water quality, proper sanitary practices, and disease

development, it is essential to ensure public awareness through knowledge (Khalid et al., 2018). Public awareness remains a major gap to be fulfilled if water management is to be improved in the study area.

Restricted access to treated water ($X=3.98$) also pose a constraint on the appropriate management of water resources. This constraint turns out to be significant because the only compliance agency WASEP (Water and Sanitation Extension Program) in the study area treats stream water for drinking water supply to the study area but it was revealed in the survey that not everyone in the area has access to that treated water.

The perception that waste management is perceived as a dirty profession also presented significance ($X=3.41$). This pose limitation of the waste handling and the adoption of improved waste management technology. Such cultural biases play a major role to restrict effective waste management and in limiting the necessary workforce required for development of the sector (Aderogba, 2014).

Table 3 Options to Change People's Attitudes and Behaviors

S/N	Options	SA	A	N	D	SD	Mean(X)	STD
1.	Awareness campaigns	122	61	13	4	0	4.50	0.70
2.	Enforcement of sanctions	121	67	5	7	0	4.51	0.71
3.	Ensuring high literacy rate	127	57	7	8	1	4.50	0.78

Note: SA denotes Strongly Agree, A denotes Agree, N denotes Neutral, D denotes Disagree, SD Strongly Disagree

Source: Author's survey, 2020

The table 4 shows respondent's perception on the realistic options for successfully changing resident's behavior and attitudes towards open waste dumping and polluting water resources. Enforcement of sanctions was considered the most realistic option to create a visible change in people's attitudes and it was significant at the mean of 4.51. As polluting the water sources appears to have become a social norm in the study area, this makes it necessary for the establishment of social or legal sanctions. Only if the cleanliness norms could be internalized by awareness, then the need of implementing formal sanctions would be disregarded.

Respondents also favor ensuring higher literacy rate ($X=4.50$) in the study area will bring a significant change in people's behaviors to guarantee protection of water resources. Field survey revealed that residents perceive that regular awareness campaigns will help make people more responsible and educated about the consequences of their attitudes and behaviors. Majority of the respondents showed agreement with the option to conduct awareness campaigns making it a significant response with the mean of 4.50. In Sri Lanka, a study by Nauges and Berg (2009) confirms that households aware of the risks of consuming untreated water are more likely to treat water before consumption to lower the health risks. They also concluded that better educated and aware households had higher probability of treating water.

4.2 PART B: Interview interpretation

To study the human attitude towards water pollution and the barriers for improvement of water quality in the study area, qualitative interviews were conducted. Interviews also focused on the present constraints on treatment of drinking water and the future potentials for protection of drinking water sources and the prospective enablers to change human behavior. Interviews were conducted from officials from water management department, waste management department, education department, health department, district health officer, and from a community volunteer.

This section mainly focuses on the objective of studying the mindset, attitudes, and behaviors of local population of Gahkuch relevant to drinking water quality and to explore the barriers and enablers for improving water quality.

4.2.1 Section A: Reasons behind human related water quality issues

Question 1: What are the human activities that contribute to poor water quality?

Respondent 1: 'It varies according to the location and circumstances, but basically people throw shopping bags and other plastic wrappings into the water sources and it doesn't get removed, so plastic waste gets accumulated into the water, which degrades water quality and causes different illnesses. This practice is increasing day by day and people throw plastic wrappers everywhere which is causing a lot of problems. Natural beauty of the water system and the water from springs which is our source of drinking water is being destroyed. The tourists who visit these places for the sake of recreation also dump waste into this water or leave it openly in these locations rather than bringing it back with them. Even inside the town, the problem persists due to excessive use and dumping of plastic materials. Even the water tanks built by WASEP are being contaminated by people'

Respondent 2: 'People wash clothes in the water channels that comes from the springs and flows throughout the town. Due to which the detergents and soap get into the water channel and all those chemicals get mixed in the drinking water sources. Also, there are chances of contamination because the water in the channels is muddy due to glacier melting and some soil and sediments get dissolved in this water while flowing down to the channels. Riverside is very polluted with solid waste. Even dirty diapers are thrown in the river. The river takes all the solid waste with it and people still need to use this water'

Respondent 4: 'I think most water quality issues are due to lack of sanitary system in Gahkuch. There is no proper sewerage system here. The river is so close here, if we dig two to three feet in-ground, the water table becomes accessible. So, due to the lack of sewerage system, people dig in the ground to make ground pit toilets, which can easily get its way into the river water. So, most of the water quality issues are related to sanitary problems. River water is being used for drinking purpose which makes health problems very common here. This is a developing area and development is taking place very rapidly, many construction projects are also going on, which is also contributing to pollution of water'

Respondent 6: 'People here very commonly wash clothes, utensils, and cars near the river. Detergents and washing chemicals enter the water, which affects the aquatic life as well as humans who directly consume river or channel water. Agriculture is a common practice in this area and the fertilizer that is being used in upstream agricultural areas also gets its way to the drinking water. Also, people dig ground pits for their toilets and some of them secretly dig the pits all the way to river water table. So, the wastewater from toilets and the kitchen also leads there. This is not known to everyone, because people do this as a hidden practice'

The outlook of these responses reflects the lack of knowledge of the local population about the consequences of their actions, which leads to water contamination. It also indicates the disparities in water management system which is dependent on the socio-economic characteristics of the study area. Absence of sewerage system in the study area worsens the conditions and drives humans to opt the limited options they have and that too at the stake of their own health. The above findings corroborate with those of an earlier study by Azizullah et al. (2011), which stresses that in rural areas where water table is low, by leakage or from unauthorized connections sewerage

disposal systems cause bacterial contamination of water distribution systems, making population prone to water-borne diseases like diarrhea, nausea, typhoid, dysentery and other health problems.



Figure 22 Water Tank for Drinking Water Supply



Figure 23 Water Tank Contaminated with Solid Waste Materials

It was also observed (as shown in the figures 22 and 23) that the water tanks built up by WASEP (Water and Sanitation Extension Program) also have various waste materials in them. One of the reasons being that these tanks do not have roofs which makes them an easy target of contamination by the local population.



Figure 24 *Washing of Utensils by a Roadside Restaurant*



Figure 25 *Cloth Washing in Water Stream*

Figure 24 and 25 show people washing utensils and clothes in the water streams that run downstream. As stream water channels run outside the houses and the commercial region in the study area, it becomes the most accessible and easily exploited surface water source by the public. Also, because these channels capture water from the springs which continuously flow in the summer season, people might consider this water source to be infinitely available.

4.2.2 Section B: Human attitudes, mindset and behaviors pertaining to water pollution

Question 2: In your opinion, what are the reasons that people dispose waste openly?

Respondent 1: 'People are not aware of the consequences of throwing waste in the water channels, which causes blockage at some points. People throw shopper bags on the roads and others can easily see them, but no one would come forward and pick it up. People do not have the awareness to remove their solid waste'

Respondent 2: 'Actually, people do not bother because there have not been any evidences of an epidemic due to a waterborne disease. If there was one, then people would have established a mindset that such disease in being caused due to water quality issues but there has been no evidence of such an epidemic situation in Gahkuch. There is one project in Gilgit-Baltistan on provincial level, which is a hepatitis program, but the program is not properly working. They have not disseminated this information to the people of Gahkuch, so people are not very conscious of their behavior'

Respondent 4: 'The awareness through media and the internet which is more accessible to people these days lacks here. When the population increases, development occurs and people migrate from outside. So, the people who come from other districts are less aware. Those people are illiterate and unaware of the importance of the use of toilets, so open defecation happens because of them. This area has faced a fairly recent development, within past four to five years. I think if there was a holistic development planning, before initiating the development then it would have resulted in better management. If the issues of water and waste management would have been considered beforehand, then a lot of problems could be better managed'

From interaction with the respondents, it becomes evident that there are several reasons due to which people dispose of waste materials and pollute water resources. Most highlighted reasons behind such human behavior were, unawareness of the consequences, the ‘who-cares’ attitude, lack of press and news media, and lack of town planning. As explained by Schultz and Zeleny (2000), people possess attitudes of environmental concern majorly when they consider themselves to be a part of the natural environment they could otherwise potentially pollute. However, such attitude may be developed by awareness and knowledge, otherwise inadequate understanding of the value of environmental and sustainable actions influence people to adopt degrading behaviors (Imran et al., 2014). A study by Soliman and Wilson (2017) relate pro-environmental behavior to possessing growth mindset, however, more research is required to study if fixed mindset can be changed into growth mindset or not (Duchi et al., 2020).

Question 3: What typical mindset and attitudes of people put constraints on mitigation of water quality problems?

Respondent 1: ‘People lack a sense of responsibility. We eat and throw wrappers everywhere thinking that the waste collection workers will come and collect it. People here depend on government or NGOs to come and take initiatives for us. They have become used to of the concept that someone from either the government or an NGO will come and help them. They do not contribute themselves to manage at the community level’

Respondent 2: ‘People here have developed a mindset from 20 or 50 years that the solid waste should be just thrown anywhere. So now if one goes and suddenly tells them to throw the trash in the bin then they would not easily develop the habit. This is such a small town but still, it is hard to reach every person and force them to throw the waste in the bin. People pollute the water sources out of habit. They need to be made aware of the consequences, of polluting water and

wasting water by leaving the taps open. Everyone needs to be made aware of it but in Gahkuch due to the rapid increase in population this issue is not being properly dealt with'

Respondent 6: 'It has become our habit; we do not care about cleanliness and we do not care about others. We do what we feel like without thinking of others or the environment. This town has very limited channel water and the only source is through springs. People clean their houses but throw all the waste outside their houses. Most of the times people are not even ready to listen or understand the situation. No one is ready to take their individual responsibility here. Everyone thinks that it would not cause any problem if I threw waste openly, but then this thought of everyone collectively causes a huge issue'

The qualitative interviews revealed that there is a general mindset of the population under study that it is not their responsibility to keep the town and water resources clean. The most salient response was that people lack the sense of responsibility and consider it to be a job of the municipal workers to care about the cleanliness. Also, due to the lack of awareness, it has become a habit of people to throw solid waste anywhere they want, without considering the consequences it could cause. Norm Activation Model (NAM) (Schwartz and Howard, 1980) explains, when people are aware of the consequences of their actions, they are more likely to avert their behaviors. Awareness instills the ascription of responsibility (AR) in people, making them to consider it a moral obligation to take the right action.

4.2.3 Section C: Barriers and enablers for improvement of water quality management

Question 4: What are the barriers at institutional level for improvement of water quality management?

Respondent 1: 'There is not enough funding to solve these problems. Only WASEP operates based on the limited funding that is provided to our area. There are no other institutions or organizations working for this issue at a remarkable level. The government does its limited part but there is a lack of other non-governmental organizations and private companies. There is no special team for health education so it is impossible to reach every house for individual awareness. People here know about cleanliness because they keep their houses clean but environmental management lacks in this region'

Respondent 2: 'At some places, it is easy to supply water from the channels but at some remote locations it is not possible to provide water through the channels. Then either some organizations help provide water or people fill up water themselves from the river'

Respondent 4: 'Media is weak here; print media and electronic media is not present. Even if the government arranges any awareness activities, the newspaper reaches us after two days after being printed in Rawalpindi. We get the news from the newspaper after two days then how would we know about such campaigns if the news does not even reach local people timely'

Respondent 5: 'The policy of the government is not that strong for areas like ours. It is not designed or implemented properly. Funds get supplied but they are not enough to provide any quality work. If government provides some drinking water scheme then there is no community participation in it. Government and contractor do the installation with no community share, so it does not provide some quality outcome'

Respondent 6: 'The literacy rate is quite high here in Ghizer district but education still lacks a standard. Children are reading books but they are not getting the awareness from the syllabus. Training of children does not take place here. Even the students from the best schools do not have awareness about health issues and waste disposal. There are only one or two institutes which are better but they still lack training in environmental aspects'

This discussion addresses the third objective of investigating the barriers and enablers in improvement of water quality. Respondents mainly consider the lack of effective policy and lack of funding to be the barriers at legal levels for water quality improvement. This issue was also presented in a study by Azizullah et al. (2011), which showed that a number of policies and acts have been formulated but due to the lack of a clear implementation strategy, only a little effective management efforts are established.

One of the participant drew attention to the absence of NGOs and news media as to be the barriers, which could otherwise help disseminate information and awareness. WASEP (Water and Sanitation Extension Program) by the AKRSP (Aga Khan Rural Support Program) is the only initiative in the region who have built water tanks. However, it was revealed in the survey and by participatory observation that these tanks are also being contaminated by the local people. This situation makes it essential to encourage public participation by means of community mobilization and awareness campaigns to ensure better water quality management of the study area.

Other participants highlighted that at institutional level, school curriculum should consist of knowledge relating to importance of cleanliness and pro-environmental behavior. An action-based study by Alam (2017) conducted in one of the community managed schools in Gilgit-Baltistan, showed promising results by observing environmentally friendly attitude and motivation among students. The students were involved in various environment related activities and were given

knowledge of environmentally responsible attitude over a span of six months. After six months, students were observed to be more sensitized towards improving their surrounding environment. Therefore, it is likely that such interventions can also be beneficial in the study area.

Question 5: What changes can be made in institutional and legal policy that could result in mindset shift?

Respondent 2: The education department must consider adding a curriculum about the environment and its aspects from the school level. It will be easy to teach the children because they learn quickly as compared to the elders. The community representative who is a notable person and people listen to them should raise environmental awareness in the community'

Respondent 3: 'There should be a policy or system of putting fines and sanctions on people who throw waste openly. Only then, people here could actually feel that they need to change. Making and implementing such a law is very difficult but maybe not impossible. There should be rules for waste management and human generated water pollution following proper maintenance and check and balance for those laws. Transgressor should be charged penalty'

Respondent 4: 'Management alone cannot do anything. Mutual cooperation should exist between management and the community. Otherwise, the situation cannot be changed. Even the highest technology cannot help solving this issue, until the community becomes responsible and children help us, nothing can change. Everything goes well in a balance so, after the implementation of a law, check and balance play an important role'

Respondent 5: 'There should be proper campaigns to make people more environmentally aware. Campaigns should be conducted at regular intervals to make a difference. Or there should be advertisements on television and newspaper media. There should be a government institute which

enforce people to collect solid waste at a specified location where it would be recycled. An enforcing institute needs to be made'

Respondent 6: 'The education policy change is required and training should be done. We should educate children from the school level. This will take time to create a visible difference but the situation will be better. Also, if the community is allowed to participate then they would focus to establish qualitative work and a better community can be built by responsible citizens'

The enablers for better water management mentioned by the respondents mainly involve, educating the children to raise an informed generation, regular awareness campaigns, encouraging community participation. It was also revealed that some respondents consider the study population to be stubborn regarding water management issues and demand there to be a legal system to implement sanction for transgressors. These recommended enablers align with the NAM theory that when people develop intentions to act responsibly, their attitudes towards environment become responsible too. Regular awareness campaigns can help build a social norm which in turn would shape people's attitudes and behaviors in favor to the water management.

CHAPTER 5 CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion

The review and analysis of literature showed that throughout the history of mankind, humans have generated waste and caused pollution of water resources. Solid waste has been majorly dealt by either dumping or burning. Today, water pollution has become the most prevalent environmental issue resulting in various health related effects through the outbreak of diseases. Gilgit-Baltistan acts as the water tower of Pakistan, so water quantity is not an issue in Gahkuch, GB. However, access to clean and safe water is the major issue of this region. Major factors giving rise to this issue are rapid population growth, urbanization, lack of planning, and anthropogenic activities.

It is also reasonable to conclude from literature survey in this paper that due to the continued population growth and waste generation, resulting water pollution will keep on rising. Anthropogenic activities have been the main cause of water pollution in Gahkuch, Gilgit-Baltistan. Either it be through direct dumping of solid waste or by directing sewage waste and industrial effluents into the surface water sources. However, the behavioral tendencies of people could differ in terms of how they value the water resources and their mindset relating to water conservation determines their behavior.

Through the household survey, it can be concluded that the incidences of waterborne diseases are prevalent. However, the population is majorly unaware of the causes of these diseases. The absence of proper sewerage system and household water treatment methods could be the reason for the spread of these health issues. People majorly exhibit negative environmental behaviors out of habit, ignorance, or unawareness of the consequences.

Regarding household perceptions of health risks related to consumption of degraded quality water and the impact of these perceptions on household's averting behavior. It was evidently concluded that aesthetic characteristics of water (color, odor, and taste), primarily drive household's perception of health risks. Risk perceptions appear to be significantly influenced by household's education level and the access to essential information and knowledge regarding water quality among the local community.

Regarding human attitudes behind negative environmental behavior, it was concluded that the major reasons could be unawareness of the consequences, lack of access to essential information, and not considering oneself as a part of their surrounding environment. The most significant constraints on effective water management were evidently concluded to be poor water quality legislation, low public awareness, expensive water treatment technology, and absence of specialist technical and scientific knowledge.

The major barriers relating to human attitudes and behaviors in favor of sound water quality management could be related to clearly lack of awareness campaigns and absence of social and legal sanctions. There are challenges in the interaction between management staff and local community members, which further puts constraints to the success of community participation in water management practices.

5.2 Recommendations

Following are the major recommendations suggested based on the interviews and observations of the study area:

- NGOs should be more proactive in the study area to conduct regular awareness campaigns and to provide essential health related knowledge to the community. It was also extensively

stated by the interviewees as they considered need for awareness campaigns that could act as a greater enabler in terms of widespread management of water quality and human health.

- The water management department officials should do more to properly protect the available water tanks to avoid intrusion by humans, animals, and agriculture residues to enter into water resources to minimize biological water contamination.
- Local government and line agency are recommended to communicate and collaborate with the educational institutions/academics to include curriculum relating to environmental education and encourage students to practically involve in environment friendly activities with social responsibility.
- It is recommended that the local government provide the needed finances to strengthen mass communication (print and tv media). This will create awareness on how to prevent water contamination, protect the environment, and prevent waterborne diseases.
- It is recommended to implement various activities for active community participation in water management. Community involvement can help create a norm of social responsibility and can result in common attitude, knowledge, behavior, and norms regarding sound water management.
- There is a greater need for increased enforcement of legal measures (in terms of fines for the ones transgressing from the law) that can help encourage the correction of attitude in favor of individual responsibility towards achieving better water quality.

References

- Abbaspour, S. (2011). Water quality in developing countries, south Asia, South Africa, water quality management and activities that cause water pollution. *IPCBE, 15*, 94-102.
- Abdul-Muhmin, A.G. (2007). Exploring consumers' willingness to be environmentally friendly. *International Journal of Consumer Studies, 31*, 237-247.
- Aderogba, K. A. and Afelumo, B. A. (2012). Waste dumps and their management in Lagos Metropolis. *International Journal of Learning and Development, 2*(1), 2164- 70.
- Ajzen, I. (2002). Residual effects of past on later behavior: Habituation and reasoned action perspectives. *Personality and Social Psychology Review, 6*(2), 107–122.
- Ajzen, I., & Fishbein, M. (1980). *Understanding Attitudes and Predicting Social Behavior*. Englewood Cliffs, NJ: Prentice-Hall.
- Alam, S. (2017). Environmental Education: Role of Physical Environment in Students Learning in Gilgit-Baltistan, Pakistan. *Journal of Education and Vocational Research, 8*(2), 22–33.
- Allport, G.W. (1935). *Attitudes. In a handbook of social psychology*. Worcester, MA: Clark University Press.
- Aminrad, Z., Zakariya, S. Z. B. S., Hadi, A. S., & Sakari, M. (2013). Relationship between awareness, knowledge and attitudes towards environmental education among secondary school students in Malaysia. *World Applied Sciences Journal, 22*(9), 1326-1333.
- Azizullah, A., Khattak, M. N. K., Richter, P., & Häder, D. P. (2011). Water pollution in Pakistan and its impact on public health - A review. *Environment International, 37*(2), 479–497.
- Baig, F., Nawab, B., & Mahmood, Q. (2019). Impact assessment of sanitation system on the socio-economic aspects of local community and environment in Hunza Valley Gilgit Baltistan-Pakistan. *International Journal of Energy and Water Resources, 3*(2), 73-79.
- Ballentyne, R., Fien, J. & Packer, J. (2000). Program effectiveness in facilitating intergenerational influence in environmental education: lessons from the field. *The Journal of Environmental Education, 32*(4), 8–15
- Begum, F., Rubina, K. A., Khan, A., Hussain, I., Ishaq, S., & Ali, S. (2014). Water quality assessment using macroinvertebrates as indicator in sultanabad stream (Nallah), Gilgit, Gilgit-Baltistan, Pakistan. *Journal of Biodiversity and Environmental Sciences, 5*, 564-572.

- Biswas, A. K. (2008). Integrated water resources management: is it working?. *International Journal of Water Resources Development*, 24(1), 5-22.
- Biswas, A. K., & Seetharam, K. E. (2008). Achieving water security for Asia. In *International Journal of Water Resources Development*, 24(1).
- Biswas, A. K., & Tortajada, C. (2011). Water quality management: An introductory framework. *International Journal of Water Resources Development*, 27(1), 5–11.
- Bond, T. G., & Fox, C. M. (2013). *Applying the Rasch model: Fundamental measurement in the human sciences*. Psychology Press.
- Bryman, A. (2016). *Social Research Methods*. (5th ed.). United States of America: Oxford University Press.
- Butt, I., & Iqbal, A. (2007). Solid waste management and associated environmental issues in Lahore. *Pak Geo Rev*, 62, 45-50.
- Canter, L. W., Nelson, D. I., & Everett, J. W. (2005). Public Perception of Water Quality Risks-Influencing Factors and Enhancement Opportunities. *Journal of Environmental Systems*, 22(2), 163–187.
- Chen, T. B., & Chai, L. T. (2010). Attitude towards the environment and green products: Consumers' perspective. *Management science and engineering*, 4(2), 27-39.
- Chifamba, E. (2013). Community participation in integrated water resources management in the Save catchment, Zimbabwe. *Journal of Environmental Science and Water Resources*, 2(10), 360-374.
- Daud, M. K., Nafees, M., Ali, S., Rizwan, M., Bajwa, R. A., Shakoore, M. B., Arshad, M. U., Chatha, S. A. S., Deeba, F., Murad, W., Malook, I., & Zhu, S. J. (2017). Drinking Water Quality Status and Contamination in Pakistan. *BioMed Research International*, 2017.
- District Health Office. (2019). Population and Water Supply Systems in Households of Ghizer District. *Unpublished internal document*.
- Duchi, L., Lombardi, D., Paas, F., & Loyens, S. M. M. (2020). How a growth mindset can change the climate: The power of implicit beliefs in influencing people's view and action. *Journal of Environmental Psychology*, 101461.
- Dweck, C. S. (2012). Mindsets and human nature: Promoting change in the Middle East, the schoolyard, the racial divide, and willpower. *American Psychologist*, 67(8), 614.

- Dweck, C. S., & Leggett, E. L. (1988). A social cognitive approach to motivation and personality. *Psychological Review*, 95(2), 256–273
- Famiglietti, J. S. (2014). The global groundwater crisis. *Natural Climate Change*. 4: 945–948.
- Farooq, S., Hashmi, I., Qazi, I. A., Qaiser, S., & Rasheed, S. (2008). Monitoring of coliforms and chlorine residual in water distribution network of Rawalpindi, Pakistan. *Environmental monitoring and assessment*, 140(1-3), 339-347.
- GB-EPA, G. E. P. A. (2019). *Assessment of Drinking Water Quality “Natural Springs and Surface Water” in Gilgit-Baltistan - 2019*. Retrieved from: <http://gbepa.gog.pk/wp-content/uploads/2020/04/Drinkin-Water-Quality-Assessment-Report-of-GB.pdf>
- Gomez, J. D., & Nakat, A. C. (2002). Community participation in water and sanitation. *Water international*, 27(3), 343-353.
- Guerrero, L. A., Maas, G., & Hogland, W. (2013). Solid waste management challenges for cities in developing countries. *Waste management*, 33(1), 220-232.
- House, M. A. (1996). Public perception and water quality management. *Water Science and Technology*, 34(12 pt 8), 25–32.
- Hughes, J. A. and Sharrock, W. W. (1997). *The Philosophy of Social Research*, 3rd ed. London: Longman.
- Hughes, J.A. and Sharrock, W.W. (1997). *The Philosophy of Social Research*, 3rd ed. London: Longman.
- Hussain, A., Begum, S., Hussain, S. W., Khan, Z., & Ali, A. (2016). Analysis of Management and Environmental Effects of Municipal Solid Waste Due to Inefficient Practices Through People’s Perception in Gilgit City, Gilgit Baltistan, Pakistan. *International Journal of Scientific Research in Environmental Sciences*, 4(1), 12–16.
- Hussain, Y. (2014). Social Media as a Tool for Transparency and Good Governance in the Government of Gilgit-Baltistan, Pakistan.
- Imran, S., Alam, K., & Beaumont, N. (2014). Environmental orientations and environmental behaviour: Perceptions of protected area tourism stakeholders. *Tourism management*, 40, 290-299.
- Jackson, R. B., Carpenter, S. R., Dahm, C. N., McKnight, D. M., Naiman, R. J., Postel, S. L., & Running, S. W. (2001). Water in a changing world. *Ecological applications*, 11(4), 1027-1045.

- Janz, N. K., & Becker, M. H. (1984). The health belief model: A decade later. *Health education quarterly*, 11(1), 1-47.
- Karant, K. K., Kramer, R. A., Qian, S. S., & Christensen Jr, N. L. (2008). Examining conservation attitudes, perspectives, and challenges in India. *Biological Conservation*, 141(9), 2357-2367.
- Khalid, S., Murtaza, B., Shaheen, I., Ahmad, I., Ullah, M. I., Abbas, T., ... & Imran, M. (2018). Assessment and public perception of drinking water quality and safety in district Vehari, Punjab, Pakistan. *Journal of Cleaner Production*, 181, 224-234.
- Khan, S., & Hanjra, M. A. (2008). Sustainable land and water management policies and practices: a pathway to environmental sustainability in large irrigation systems. *Land Degradation and Development*, 19(3), 469–487
- Kinzig, A. P., Ehrlich, P. R., Alston, L. J., Arrow, K., Barrett, S., Buchman, T. G., Daily, G. C., Levin, B., Levin, S., Oppenheimer, M., Ostrom, E., & Saari, D. (2013). Social Norms and Global Environmental Challenges: The Complex Interaction of Behaviors, Values, and Policy. *BioScience*, 63(3), 164–175.
- Kumar, R. (2005). *Research methodology: A step by step guide for beginners*. London: Sage
- Levine, D. S., & Strube, M. J. (2012). Environmental attitudes, knowledge, intentions and behaviors among college students. *The Journal of social psychology*, 152(3), 308-326.
- Magilvy, J. K., & Thomas, E. (2009). A first qualitative project: Qualitative descriptive design for novice researchers. *Journal for Specialists in Pediatric Nursing*, 14(4), 298-300.
- Mansaray, A. and Abijoye, J.O. (1998). Environmental knowledge, attitudes and behaviour in Dutch secondary school, *Journal of Environmental Education*, 30(2), 4-11.
- Maxwell, J. A. (2012). *Qualitative research design: An interactive approach*, vol. 41: Sage publications.
- Mohsin, M., Safdar, S., Asghar, F., & Jamal, F. (2013). Assessment of drinking water quality and its impact on residents health in Bahawalpur city. *International Journal of Humanities and Social Science*, 3(15), 114-128
- Nabeela, F., Azizullah, A., Bibi, R., Uzma, S., Murad, W., Shakir, S. K., ... & Häder, D. P. (2014). Microbial contamination of drinking water in Pakistan—a review. *Environmental Science and Pollution Research*, 21(24), 13929-13942.

- Nauges, C., & Van Den Berg, C. (2009). Perception of health risk and averting behavior: An analysis of household water consumption in Southwest Sri Lanka.
- Palmer, J.A. (1998). Environmental education in the 21 century: Theory, practice, progress and promise. London: Routledge.
- PCRWR. (2015). *Pakistan Council of Research in Water Resources, Annual Report, Islamabad*. [http://www.pcrwr.gov.pk/Publications/Annual%20Reports/Annual%20Report%202015-16%20\(Published\).pdf](http://www.pcrwr.gov.pk/Publications/Annual%20Reports/Annual%20Report%202015-16%20(Published).pdf)
- PCRWR. (2016). *Pakistan Council of Research in Water Resources, Annual Report, Islamabad*. <http://www.pcrwr.gov.pk/Publications/Annual%20Reports/PCRWR%20Annual%20Report%202016-17.pdf>
- PCRWR. (2019). *Pakistan Council of Research in Water Resources, Annual Report, Islamabad*. <http://www.pcrwr.gov.pk/Publications/Annual%20Reports/Annual-Report-2018-19.pdf>
- Peters, N. E., & Meybeck, M. (2000). Water quality degradation effects on freshwater availability: Impacts of human activities. *Water International*, 25(2), 185–193.
- Plappally, A. K., & Lienhard, J. H. (2013). Costs for water supply, treatment, end-use and reclamation. *Desalination and Water Treatment*, 51(1-3), 200-232.
- Postel, S. L. (2003, May). Securing water for people, crops, and ecosystems: new mindset and new priorities. In *Natural Resources Forum* (Vol. 27, No. 2, pp. 89-98). Oxford, UK: Blackwell Publishing Ltd..
- Pradinaud, C., Northey, S., Amor, B., Bare, J., Benini, L., Berger, M., ... & Motoshita, M. (2019). Defining freshwater as a natural resource: a framework linking water use to the area of protection natural resources. *The international journal of life cycle assessment*, 24(5), 960-974.
- Rosemann, N. (2005). Drinking Water Crisis in Pakistan and the Issue of Bottled Water: The Case of Nestlé's 'Pure Life.'. *Actionaid Pakistan*, 4, 37.
- Rosenstock, I. M. (1990). The Health Belief Model: explaining health behavior through experiences. *Health behavior and health education: Theory, research and practice*, 39-63.
- Saleem, M., & Salman, A. (2011). *Viable household water treatment methods*. Islamabad: Sustainable Development Policy Institute.
- Saunders, M., Lewis, P. and Thornhill, A. (2016). *Research methods for business students*. London: Pearson

- Schultz, P., & Zeleny, L. (2000). Psychology of Promoting Environmentalism: Promoting Environmentalism. *The Journal of Social Issues*, 56(3).
- Schwartz, S. H. (1977). Normative influences on altruism. *Advances in experimental social psychology*, 10(1), 221-279.
- Schwartz, S. H., & Howard, J. A. (1981). A normative decision-making model of altruism. *Altruism and helping behavior*, 189-211.
- Shedayi, A. A., Jan, N., Riaz, S., & Xu, M. (2015). Drinking water quality status in gilgit, pakistan and who standards. *Science International*, 27(3).
- Sohaila, M. T., Aftabb, R., Mahfoozc, Y., Yasare, A., YatYenf, S. A. S., & Irshadh, S. (2019). Estimation of water quality, management and risk assessment in Khyber Pakhtunkhwa and Gilgit-Baltistan, Pakistan. *Desalination and Water Treatment*, 171, 105-114.
- Soliman, M., & Wilson, A. E. (2017). Seeing change and being change in the world: The relationship between lay theories about the world and environmental intentions. *Journal of Environmental Psychology*, 50, 104–111
- Steg, L., & Gifford, R. (2008). Social psychology and environmental problems. *Applied social psychology: Understanding and managing social problems*, 1-27.
- Swim, J., Clayton, S., Doherty, T., Gifford, R., Howard, G., Reser, J., ... & Weber, E. (2009). Psychology and global climate change: Addressing a multi-faceted phenomenon and set of challenges. A report by the American Psychological Association's task force on the interface between psychology and global climate change. *American Psychological Association, Washington*.
- Uddin, S. M. N., Muhandiki, V. S., Sakai, A., Al Mamun, A., & Hridi, S. M. (2014). Socio-cultural acceptance of appropriate technology: Identifying and prioritizing barriers for widespread use of the urine diversion toilets in rural Muslim communities of Bangladesh. *Technology in Society*, 38, 32-39.
- Unicef, & WHO, D. (2009). Why children are still dying and what can be done. New York: The United Nations Children's Fund (UNICEF). *World Health Organization (WHO)*.
- Vandenbergh, M. P. (2004). Order without social norms: How personal norm activation can protect the environment. *Nw. UL Rev.*, 99, 1101.

- Vatn, A. 2005, *Institutions and the Environment*. Edward Elgar. Cheltenham, UK. Northampton, MA, USA.
- Verplanken, B., & Orbell, S. (2003). Reflections on past behavior: a self-report index of habit strength 1. *Journal of applied social psychology*, 33(6), 1313-1330.
- W.W.F. (2007). Pakistan's water at risk, water and health related issues and key recommendations. *Freshwater & Toxics Programme, Communications Division, WWF Pakistan*.
- Wiener, J. L., & Sukhdial, A. (1990). Recycling of solid waste: directions for future research. In *AMA Summer Educators' Conference Proceedings* (Vol. 1, pp. 389-92). Chicago, IL: American Marketing Association.
- Wisner, B., Blaikie, P., Cannon, T., & Davis, I. (2004). *At Risk: Natural Hazards. People's Vulnerability and disasters*. London, England: Routledge.
- World Health Organization, & UNICEF. (2006). Core questions on drinking water and sanitation for household surveys. Retrieved from:
https://apps.who.int/iris/bitstream/handle/10665/43489/9789241563260_eng.pdf
- Zak-Place, J., & Stern, M. (2004). Health belief factors and dispositional optimism as predictors of STD and HIV preventive behavior. *Journal of American college health*, 52(5), 229-236.

APPENDICES

Appendix 1 Survey Questionnaire

Section 1 Socio-demographic profile

1. Gender a) male b) female
2. Age of respondent _____
3. Marital status
 - a) Single
 - b) Married
4. Education level
 - a) Illiterate
 - b) Primary
 - c) Middle
 - d) Secondary
 - e) Bachelors
 - f) Masters
5. How many family members your household have? _____
6. How many children are there in your household under the age of 14? _____

Section 2: Water Source and Quality

7. What is the main source of water in your household?
 - a) Public supply from water tank
 - b) Direct from stream/river/spring
 - c) Community Tap
 - d) Ground water
 - e) Water tanker
 - f) Other_____
8. Does your household treat water before drinking?
 - a) Never
 - b) Rarely

- c) Sometimes
 - d) Often
 - e) Always
9. Generally, what do you think the drinking quality of your household's water is?
- a) Very poor
 - b) Poor
 - c) Fair
 - d) Good
 - e) Very good
10. Do you have shortage of drinking water?
- a) Yes
 - b) No
11. How does your drinking water taste?
- a) Excellent
 - b) Good
 - c) Acceptable
 - d) Unacceptable
12. Do you have facility of toilet in your household?
- a) Yes
 - b) No
13. If yes, what type of toilet is it?
- a) Sewerage line
 - b) Ground pit
 - c) Open pit
 - d) Directed to water channel
14. Do you have stagnant water near your household?
- a) Yes
 - b) No
15. Does unsafe water affect the health of your household?
- a) Yes
 - b) No
 - c) Maybe

16. Does unsafe water cause waterborne diseases to any of your family members?

- a) Yes
- b) No
- c) Maybe

17. If yes, select the diseases listed below

- a) Diarrhea
- b) Malaria
- c) Dengue
- d) Typhoid
- e) Cholera
- f) Vomiting
- g) Abdominal pain
- h) If any other_____

18. Do you have easy access to proper healthcare facility?

- a) Yes
- b) No

Section 3: Solid waste and health

19. How do you manage the solid waste generated in your household?

- a) Recycling
- b) Reuse
- c) Converting waste to energy
- d) Do not manage

20. Do you have solid waste piles near your house?

- a) Yes
- b) No

21. What is the reason of open dumping of waste?

- a) No dustbins nearby
- b) Because of habit
- c) Because everyone does so
- d) I do not think it will cause a problem

22. Does already existing waste make you throw more waste in that place?

- a) Always
- b) Often
- c) Sometimes

- d) Rarely
- e) Not at all

23. Do you openly dump waste around water resources?

- a) Yes
- b) No

24. Do you think dumping waste in water can be harmful?

- a) Yes
- b) No

Section 4: Constraints on waste management and water quality

25. Which of the following are constraints on proper water quality management?

S/N	Constraints	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
a)	Insufficient waste collection points					
b)	Far distance to waste collection points					
c)	Lack of public water supply systems					
d)	Lack of private companies					
e)	Lack of treatment technology					

26. Which of the following do you think is a constraint on water pollution reduction?

S/N	Social/Technological/Economic constraints	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
a)	Waste management is perceived as a dirty profession					

b)	Low funding of water management operation					
c)	Inadequate technical know-how					
d)	Poor water quality management legislation					
e)	Costly water treatment technology					
f)	Restricted access to treated water					
h)	Low level of public awareness					

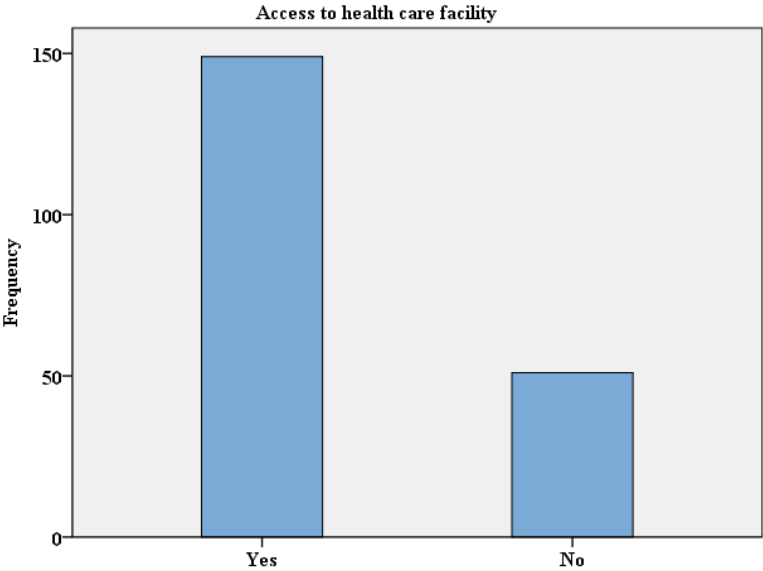
27. Which of the following options do you think can help change people’s attitudes and behaviors?

S/N	Options	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
a)	Awareness campaigns					
b)	Enforcement of sanctions					
c)	Ensuring high literacy rate					

Appendix 2 Interview Questions

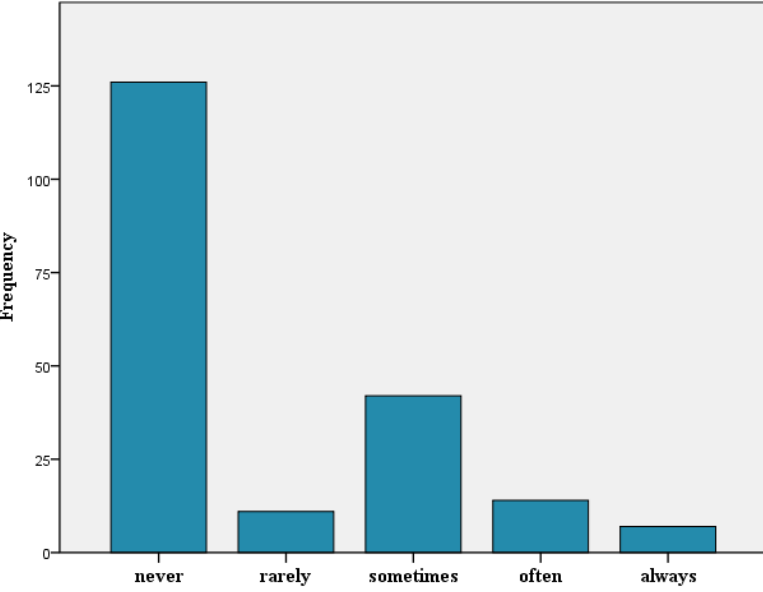
1. What are the human activities that contribute to poor water quality?
2. In your opinion what are the reasons that people dispose waste openly?
3. What typical mindset and attitudes of people put constraints on mitigation of water quality problems?
4. What are the barriers at institutional level for improvement of water quality management?
5. What changes can be made in institutional and legal policy that could result in mindset shift?

Appendix 3



Access of Respondents to Healthcare Facility

Appendix 4



Do you boil water before drinking?