Socio-Economic Determinants of Sources andAccessibility of Drinking Water and Consumers' Satisfaction:

An Insight from Pakistan

MS Economics

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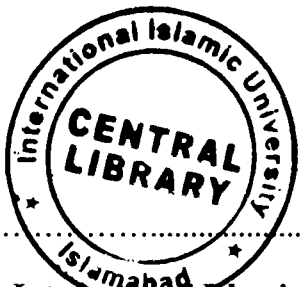

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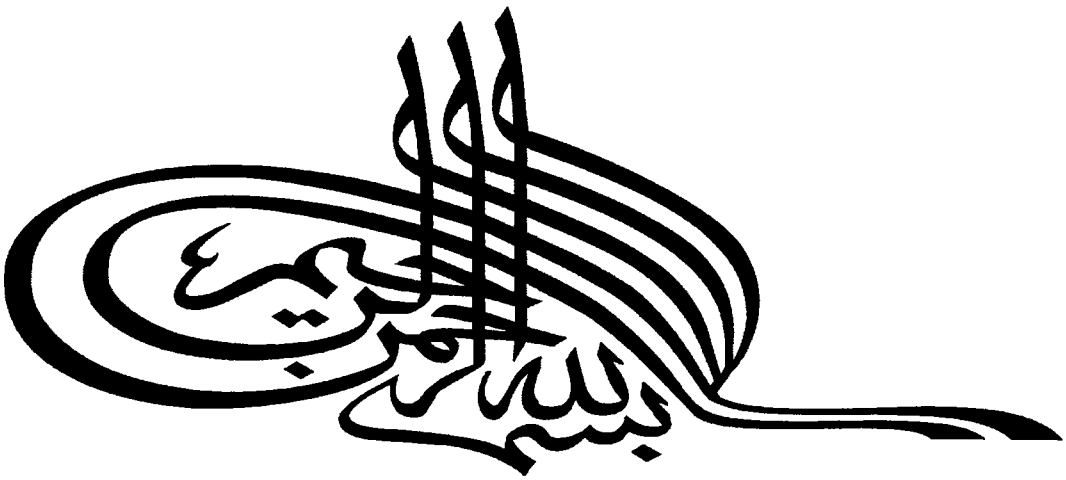

In the name of Allah,
the Most Beneficent,
the Most Merciful

Dedicated to my Beloved father (late) who gave me the confidence to face the life courageously, to my mother, who introduced me to the world of Love and my Husband who is a Blessing of ALLAH for me.

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Abbreviations

UNDP	United Nations Development Program
WATSAN	Water and Sanitation
WHO	World Health Organization
UN	United Nation
GDP	Gross Domestic Product
MNL	Multinomial Regression Model
FATA	Federally Administered Tribal Areas
AJK	Azad Jammu Kashmir
ICT	Islamabad Capital Territory
MICS	Multiple Indicator Cluster Survey
WTP	Willingness to Pay
LCB	Lahore Cantonment Board
MCC	Millennium Challenge Corporation
TBSC	Tbilisi Business Service Challenge
KP	Khyber Pakhtunkhwa
LT	Latrine Availability
WA	Water Availability
WS	Water Source
HHH	Household Head

Abstract

Drinking water is the ample need for all human being, without water it would merely impossible to live on this planet. Drinking water therefore must be safe for drinking in order to ovoid the risk of diseases caused by drinking water.Beside being available to every human to the nearist should also besafe. As it takes time and energy to fetch water for drinking from far away places .The key objectives of this study is to assess the main determinants which plays significant role in concluding source of drinking water used by different type of households whether Demographic, socio-economic or Gepgraphic. In addition to this accessibility of drinking water across Pakistan and satisfaction of consumers with the availablility of drinking water will also be the main focus of study. The data for this study is collected by UNDP survey of "Social Audit of Local Government and Delivery of Public Services". The analytical study also examines those determinants which tempt to the source and availability of drinking water to Households in Pakistan with regard to locality i.e. Urban /Rural. The models are estimated using a multinomial logistic approach applied to the sample size of 22387 households. This study emerges the very first approach to figure out and enumerate the impact of individual determinants on sources and Availability of drinking water in Pakistan. Our findings reveal that educational erudition, pro-quality, living standards, family size, facility of electricity and gas, socioeconomics and demographic variables are significant factors in determining sources and availability of drinking water.

Declaration

I hereby declare that this thesis, neither as a whole nor as a part thereof, has been copied out from any source. It is further declared that I have carried out this research by myself and have completed this thesis on the basis of my personal efforts under the guidance and help of my supervisor. If any part of this thesis is proven to be copied out or earlier submitted, I shall stand by the consequences. No portion of work presented in this thesis has been submitted in support of any application for any other degree or qualification in International Islamic University or any other university or institute of learning.

Nayab

Acknowledgment

In the name of Allah (SWT), the most gracious and the most merciful. I hereby humbly acknowledge the Allah (SWT) has bestowed me with the courage and ability to ponder over the already existing ocean of knowledge. Peace and blessings be upon the Holy Prophet (PBUH), who is the beacon of knowledge and wisdom.

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Nayab

Chapter 1

Introduction

Drinking water is the elementary requirement of human being and the prominent part of healthcare and poverty reduction., Kofi Annan ; a previous UN Secretary General quoted that "only single step that would do more to curtail disease and protect lives in under develop countries is to bring pure drinking water to all" (Referred in Water Matters 2003). According to WHO the report2004, 1.1 billion people do not have access to safe drinking water sources and about 2.6 billion have do not have better hygienic environment, which comprises 17% and 42% of the world's overall population likewise. Lack of access to water and sanitation is a humble way of expressing a type of non-availability which is a serious threat to life, destroys opportunity and ignoring the self-esteem of human being. People having no access to water mean that people live in the areas which are ruined with human and /or animals and there is not enough water required for basic human needs. As World Bank (1994) noted that impure drinking water resulted in illness and death besides also enhance the health expenses and reduces worker output and literacy rate. Impure drinking water resulted in the deaths of 3,883 people in 2012 as compared to 3,314 people in 2011. In 2011, number of 1, 02, 31,049 cases of severe diarrhea were reported of which 1,269 people passed away .Out of 1, 17, 01,755 diarrhea patients, 1,647 expired in 2012, (Federal Ministry of Education and Research, 2012).Poor environmental hygiene of water and food cause in Diarrheal diseases. Water based disease spread by drinking infected water is responsible for major out breaks of face-oral diseases such as typhoid, cholera, dysentery and diarrhea. The international community being part of the

Millennium Development Goals, has set a target that by 2015 it will decrease the ratio of people without adequate access to safe drinking water by 50 % compared to its level in 1990 (UN 2010).

On the other hand, although increasing improved water infrastructure is necessary but it alone does not promise safety of water to its users: Access is an intermediate output and has to be combined with favorable demand to generate desired outcomes among users (Larson, Minton, and Raza Findralambo 2006). Evidences from Recent empirical research (for example, Vasquez et al. 2009; Klee Meier 2000) also point outs that improved water supply schemes in many developing countries are not working appropriately. Thus, "in addition to increasing access through implementation of Improved water supplies, it is also necessary to ensure that both new and existing water Systems are sustainable, so that access to safe water is sustained for all" (Harvey 2008,117).

According to Yaser et.al 2001 Pakistan is the sixth largest country in the world by population. With a population of 182.59 million people in 2013 with 225 people per square km which is expected to rise 228.8 million by 2025 and furthermore to 295 million 2050 which will directly affect water sector for meeting the domestic, industrial and agricultural needs. Pakistan's available resources of water are fully consumed and is thus on the edge of becoming a water deficit country. In 2000 169,384 billion m^3 of water was withdrawn, 96% of which were used for agricultural purposes, leaving 2% for domestic and 2% for industrial use. As compared to 2003 the per capita water availability of 1200 cubic meter by year 2012 has dropped to less than 1000 cubic meter. Quality of ground and surface water is low and is becoming

further worsening because of untreated industrial and municipal wastes. (World Bank, 2013).

WATSAN falls under one of the neglected sector in Pakistan. The spending on the sector is lowest as compared to other social government sectors. However with time the budgetary spending is slightly increasing. After becoming a participant to the United Nations' Millennium Declaration in the year 2000, in the last five years the share of GDP for the sector has improved to only 0.13 percent from0.12 percent, the progress was just of0.01 percent of GDP between 2000-01 and 2004-05 which rise to 4% only in 2013. This shows the commitment of the public sector to spend in the WATSAN sector.

It is important to know that all the human have accessibility to water excluding in emergency situations. But accessibility does not solve the issue yet. The question thus arises if the available water is fulfills the requirement of those human and is it safe enough to drink or not? Same is the case with sanitation, as contaminated water produces health issues and so many diseases difficult to cure with a number of environmental threats to the people living nearby.

Nevertheless, regardless of the significance of providing safe drinking water for eradicating poverty and social development, comparatively slightly is known about users' satisfaction with rural drinking water services in developing countries, predominantly in South-Asia. Examining users' assessment of these services is progressively seen more as an important means for improving the performance of public services (Deichmann and Lall 2007). This paper attempts to shed light on this issue for households in Pakistan. My main purpose is to examine the sources of drinking water used by people in different localities and to investigate whether access to an improved water supply has increased users' satisfaction with quality and

availability. The study will utilize UNDP household survey data collected by UNDP through its project social audit of governance and delivery of public service 2009-10 and 2011-2012.It was conducted all over Pakistan to find the performance of different public services delivery. Our study is supplement with drinking water facility survey. The survey collected socio-economic information such as socio economic, demographic characteristics, education, health status, drinking water and other facilities. The Drinking water statistics provides detailed description of sources of drinking water, distance of source of drinking water from residence of the consumer, per month expenditures on safe drinking water, consumers' satisfaction level with drinking water available to them.

1.1 Significance of Study:

It was time long ago, when plentiful water supply was available and considered as free good. Due to increased population and economic numerous sources of water have now become contaminated and that is the reason that safe drinking water has become a scarce good. With time, availability of per capita drinking water is has decrease in all over the world including Pakistan. In 1951, water availability was about 5,000 cubic meters which in 2005declined to 1,100 cubic meters; this availability of water is just slightly above the scarcity level recognized internationally. And if the same condition continues and adequate measures required are not taken for water reservation the per capita water availability will be as low as 700 cubic by 2025 [WWF Pakistan (2007)].In Pakistan during 2004-05, people with no access to safe drinking water was 38.5 million and people with no improved sanitation was approximately 50.7 million [Khan and Yaser (2007)].

It is the basic right of human life to have accessibility to safe drinking water and now doubt drinking water we take has greatly effects our health. Polluted drinking water not only sickens us, but in response to sickness we have to pay cost for curing, our efficiency to work reduces, school enrollment lowers, and lastly leads to poverty.

Consequently, safe drinking water is an indispensable element of primary health care and is important for poverty reduction. Polluted drinking water is repeatedly well thought-out a key danger to health in developing countries and the largest part of fatal diseases are linked with it.

By using quality drinking water through standardized piped water supply can lessen the health risks from polluted water. If improved water supply is achieved worldwide it can reduce the diarrhea morbidity by 6 to 25 percent per annum [WHO (2004)].

Identifying which factors influence household water management can help policy makers target interventions to improve drinking water quality for communities that may not receive adequate water quality at the tap.

1.2 Objectives

The main objectives of the study are a follows

1. To examine the sources of drinking water used by people in different localities.
2. To investigate whether access to an improved water supply has increased users'

   Satisfaction with drinking water.
3. To find out the Socio-Economic determinants of sources of drinking water.

The Drinking water statistics provides detailed description of sources of drinking water, distance of source of drinking water from residence of the consumer, per month expenditures on safe drinking water, consumers' satisfaction level with drinking water available to them.

The study will utilize UNDP household survey data collected by UNDP through its project social audit of governance and delivery of public service 2009-10 and 2011-2012.It was conducted all over Pakistan to find the performance of different public services delivery. The above was supplement with education facility survey. The survey collected socio-economic information such as socio economic, demographic characteristics, education, health status, drinking water and other facilities.

1.3 Organization of Study

The structure of study is arranged in a following way. Chapter two elaborates the relevant literature review which warrants the empirical foundation for our research work. Chapter three explains the compilation of data techniques. Chapter four portrays the outcome of estimations, its explanation and relative importance. Chapter five concludes the study with some recommendations about the applicability of health policy and future research suggestions

Chapter 2

Literature Review

2.1 Background

Safe Drinking water is the basic human right. So strategic policy formation in all drinking water system should be based on information relating to safe drinking water system promoting, seeking and utilization behavior and factors that determining these choices of drinking water sources. All such behaviors occur within some institutional structure such as family, community or may be seen in various contexts: physical, socioeconomic, geographical and cultural. Therefore, the utilization of drinking water system, in-house or outside the house, optimal, intermediate or not safe may depend upon socio-demographic factors, social structures, level of education, cultural beliefs and practices, disease pattern (Abebaw, 2011).

Some people use in-house such as tap water, well in house, tube well in house facilities for drinking, some uses public tap near house, well in street, tube well outside the house source of drinking water while many others use river and spring water. The question now is what really drives the choice of drinking water source? (Sattar*et.al,* 2007). In following this question, (Haq*et.al* 2007), (Gelashvili, 2010), (Nagata, 2011), and (Abebawet.al, 2011) all these studies showed that an emblematic problem in developing countries is that there is severe need for policy makers to ensure safe drinking water accessible to all. They said that distance is the main issue to utilize the facility. But in this study, travel time is entering in utility function as a nuisance parameter in discrete choice model and price effect is independent with income.

2.2 Literature Reviews

Abebawe*t.al* in 2011 examined users' satisfaction with availability and quality of water when users were given access to improved water source. The researcher used both univariate and bivariate probit models. The results thus drawn suggest that users' satisfaction increased with improved drinking water accessibility. The effect was however high for water quality then water availability.

Nagata et al (2011)by using both qualitative and quantitative parallel mixed methods look at the socio economic determinants of drinking water perceptions of Tz'utujil Maya of Santiago Atitlan, Guatemala by taking factors such as socioeconomic ,demographics, sensory experience, memories left of historical events and water attitudes .Results from quantitative analysis revealed that practices made by the people for handling drinking water was different among difference in ethnicity, education, literacy rate, low trust in supply of water during Civil war, and recent beliefs regarding Atitlan Lake and quality of in-house pipe water supply. In addition to this, for awareness of health related issues caused by water socio economic, demographic, cultural, social and historical political factors were significant determinants of water-related health. Government must give attention to inequalities related to these factors in order to achieve sustainability.

The study of Demeke (2009) investigates the households' input in water source management by analyzing the factors such as institutional, socio-economic and exogenous that affects the choice. The study was carried out in Achefer area, in Amhara, Ethiopia and 160 households with and 16 water supply systems were simplified. Out of those 16 systems 8 were tested for water quality. The conclusion thus drawn show that the household demanding for quality and log lasting water

services actively participated in the project design and implementation .Thus there exist positive relationship between the two. The study suggest that for planning long lasting and quality drinking water supply projects these factors should be integrated.

Armand (2013) Argued that nowadays population access to safe drinking water is hot issue worldwide. Therefore, this is very important to investigate the factors that affect the household choice of getting water from different sources. The results thus found will make it easy for policy makers to take steps in order to insure accessibility of water supply to population. The paper under discussion examines the awareness of households in Cameroon about using polluted water and which factors affects the awareness level. The study data was taken from Third MICS survey held in Cameroon.Two types of water sources: drinking water and water source used for domestic use were taken. The bivariate probit model concluded positive relationship of household education level with drinking safe drinking water. The results also depict that awareness also has positive relationship with using improved water source. Households with facility of Television and Radio are more likely to opt for improved water source.

By applying contingent valuation technique the study of Haq et.al in 2007 investigates how much the household (HH) is willing to pay (WTP) for safe drinking water. The study was carried out in the district of Abbottabad Pakistan. The results shows that locality of households i.e. the HH belongs to urban or rural area , source of drinking water they use and education level of the household head have positive relationship with the HH's willingness to pay (WTP) for safe drinking water.

Sattar and Ahmad (2007) have done the similar work out for district Hyderabad. The research used the averting behavior approach for curing water contamination using

the multinomial logit model. Their result exposed that the HH Head's formal education and their exposure to mass media, significantly affects HH's WTP for the different water purification strategies. The study also indicated that education of the HH's decision-maker is more influential in determining their WTP as compared to their income level.

Saeed (2011) intended to do study to find out whether the residents of Lahore Cantonment are satisfied or not with the clean drinking water supply by the Lahore cantonment board (LBC).In the study households were separated into two income group; High and low income. Primary as well secondary data was collected with a combination of Questionnaires collection, and interviews. Questionnaires were asked from the Households and interviews were conducted with the LCB officials. Questionnaires covered Questions related to Demographic, socio-economic, monthly water bill, their sensitivity to water smell, its quality and quantity and complains if any made to the LCB. through visits to the Record Room of LCB and the information consisted of willingly available compendia and reports of LCB was collected the secondary data. Frequency distributions and percentages were the main analytical methods. The display methods used were tables and graphs.

Srinivasulu (2007) in his thesis examines the factors affecting child health due to drinking water quality and sanitation in Chromepet and Pallavaram Township of Tamil Nadu. The model has been estimated using Probit Model and Cox-Proportional Model using a Primary data. The results of the analysis show that drinking water quality, sanitation, fuel kind of used and Precautionary measures taken by the household greatly affect the health. In Cox-proportional Model, the drinking water

quality and sanitation were not important but precautionary measures are highly important indicating child mortality. This suggests the need for severe regulatory mechanism to supply clear drinking water as it is to poor who are generally affected by water related diseases.

Gelashvili (2010) drew importance on accessibility of water as basic need of all human being living in the world and if this water is contaminated it negatively effects the human health. The researcher estimated the effect of water supply by the municipal and its effect of health by taking data from a survey done by Tbilisi Business Service Center (TBSC) in December of 2009 in Georgia as an agreement Millennium Challenge Corporation (MCC) and Georgian Government in 2005.The results explore a negative price elasticity of -0.22.There was 11.36 % decrease in sickness when water supply was increased by 1 day. This effect shows that there is a need for government to ensure safe drinking water accessibility made possible to all Georgian cities.

Kousar et.al (2009) in their study argued that Pakistan is facing serious problem of water crises specially the ways of water storage is greatly affecting health of huge population adversely. Most of the Pakistan do not have access to safe drinking water and they are left with no way to use contaminated drinking water which in return affects the health of these people by causing water related disease. The study shows that factors that affect the choice of household using drinking water i.e. safe or contaminated includes education level of mother, and income of the family. The study covers three districts of Punjab provinces; both urban and rural areas were analyzed. The study was done with sample of 600 females of age group 20-60 years. The study

concludes that both factors Education of mother and income of household positively affect the choice of drinking safe water. As the years of education of mother increases she tries to avail safe drinking water. The relationship is same for income level of the household.

Haqet.al (2012) argued in their research work that serious issues regarding drinking water in Pakistan includes shortage of availability of drinking water along with pollution are becoming major threads faced by Pakistan. In Southern part of the country the water is contaminated with arsenic which is a serious hurdle to health safety and thus availability of safe drinking water in these areas. For the purpose of checking the negative effect of drinking arsenic containing water factors such as household income, gender ratio, source of income, eating source, education level, health level, and exposure to water related disease, money spent on such treatment were taken. The study was conducted in BastiRasulPur in District Rahim Yar Khan. The results found that 77% water sample were contaminated with arsenic resulting 50% people diagnosed with arsenic. Out of total earning 60% was utilized on treatment of arsenic. The sex ratio was about 1.01% for adults and 9.8 % for children. Low level of poverty and illiteracy resulted in unawareness of adverse effects of drinking this contaminated water. The Due to poverty and illiteracy, the entire population was un-aware of the undesirable impacts of drinking water arsenic contamination .The study suggest that government should start installation of sustainable community based arsenic alleviation technologies for provisioning of safe drinking water to affected community with addition to this awareness program should also be started.

Aurangzeb et.al (2007) study is based on a sample survey conducted in three randomly selected villages of district Peshawar to assess the availability and utilization of potable water and sanitation facilities .And also to recognize the factors hindering in the proper utilization of these facilities in the rural areas. For this purpose 160 respondents (20 % of the total households) were randomly contacted in the study area. The research finds that more than 50% of the population was mainly using open well water. This water was of inferior quality; however, people had to use it because they did not have access to public sector water. The rest of the community received water from tube wells in the public sector. Similarly improper storage and drainage; and disposal of garbage and toilet waste were the main causes of poor sanitation. All these factors had contributed significantly to the underutilization of the said social sector services. Mainly because of inferior quality of water and poor sanitation the people had health problems. Likewise, proper drainage and storage and disposal of garbage and toilet waste are the pre requisites for improved sanitation. Public knowledge through health and hygiene education can help a lot in the improvement of clean environment. For this purposes the district government should take necessary legal steps to stop illegal connections and misuse of water, throwing the garbage in the streets and so on. With these actions the availability and utilization of the facilities would be improve.

Shafi et.al (2005) conducted their study in 2005 with the core aim to look into the availability and utilization of rural social services (potable water supply and sanitation) and the factors responsible for the delivery of low quality services in the three purposively selected villages of district Charsadda. Fifteen percent of the sample size (130 respondents) was selected for the study. This sample size was

proportionately distributed among the three villages. The study main conclusion depicts that social services provided by the government in the area is not fulfilling the needs and also the already available ones are not fully utilized by the rural community. There are a lot of reason for insufficiency and not fully utilization of the services. The potable water supply was not easily available and was of lower quality. Similarly improper storage, disposal of garbage and toilet waste was the major reason of poor sanitation. All these factors together have contributed significantly to the under-utilization of the social services. Therefore, the study recommends that special attention should be given to the availability of clean drinking water through new water schemes. Likewise, organized drainage system, proper storage and disposal of garbage and toilet waste, construction of flush latrines and public awareness through health and hygiene education should be arranged.

The study of Yaser et.al (2011) is an addition to literature on drinking water. The study focuses on the household sensitivity regarding drinking water quality. The perception of 160 household sample size using hand pump, tube well and motor pump were checked. The outcome thus showed that bacteriological parameter fecal coliform amount were more than guidelines given by which in result made water unfit for drinking, and to their surprise the people living there were not aware of the bacteria presence in the water they were taking in women who were educated highly had however perception about the smell with $F = 3.51$, $p<0.01$, with taste the perception of same women was $F = 3.10$, $p<0.05$for turbidity in water the sensitivity was $F = 5.34$, $p<0.01$. Presence of Water borne disease more specifically in new-born was common in the locality. In addition to this shortage of proper sanitation, water

supply system and drainage facility were main factors in contribution of poor health of people.

My study is important as it is the first study done on national level in Pakistan. All other studies done on Pakistan analyzed either district level, city or local level.

Chapter 3

Model Specification, Methodology and Data

This chapter includes the model to be specified for the under discussion study, methodology to be used and data to be analyzed for the study.

3.1Data

The study under discussion used data from the project "Social Audit of Local Governance and Delivery of Public Services" conducted by United Nations Development Program (UNDP) in 2009-10 and 2011-12.Household survey covering both Urban and rural areas of four provinces of Pakistan while the areas where no local government exist such as Federally Administered Tribal Areas FATA, Islamabad capital Territory (ICT) and Azad Jammu Kashmir (AJK) were excluded. Household Sample of 12000 was interviewed in 2009-10 and 10740 were interviewed in 2011-12.Based on Six parts a structured Questionnaire was asked from the respondents .Out of Six part the First part was designed to capture information regarding Demographic information such as;

- Gender of HHH
- Age of HHH
- Education of HHH
- Income of HHH
- No. of Family members
- Number of adult females in Family
- Facility of gas and electricity in house

The main focus of the survey was to assess level of satisfaction and accessibility of basic services provided to the community by Local Government such as health ,education, roads, improve water services, sanitation and sewerage, disposal of garbage waste , transportation, electricity, gas and agriculture. I chose Drinking water section from above mentioned services for my thesis. In Drinking water sector, I selected below mentioned exemplary questions from structured questionnaire to analyze what are the main determinants of safe drinking water and what is the availability ratio of safe drinking water in Pakistan;

- From which source you use water for drinking?
- How far is that drinking water source from your house?
- How much satisfied are you from your drinking water source?

3.2Variables Description

Table 3.1 shown below shows the combination of dependent and independent variables to be used in the study.

Table 3.1: Description and Distribution of Variables Selected for this Study Sample

Dependent Variables	Description	Percentage
Source of Drinking water		
Optimal	1 if yes, otherwise 0	22.1
Intermediate	1 if yes, otherwise 0	55.6
Not improved	1 if yes, otherwise 0	22.3
Availability of Drinking water		
In house up to ¼ Km from house	1 if yes, otherwise 0	48.5
1/4km up to 1km	1 if yes, otherwise 0	38.7
1km up to 3km	1 if yes, otherwise 0	12.8
Consumer Satisfaction		
Satisfied	1 if yes, otherwise 0	20.8
Not satisfied	1 if yes, otherwise 0	66.3
Nor satisfied neither not satisfied	1 if yes, otherwise 0	13
Independent Variables		
Gender of Family Head		
Male	1 if yes, 0 otherwise	63.9
Female	1 if yes, 0 otherwise	36.1
Age of Household Head	Continuous	
Educational Capacity of Family Head		
Uneducated	1 if yes, 0 otherwise	40.1
Under Metric	1 if yes, 0 otherwise	12.1
Metric	1 if yes, 0 otherwise	11.2
Intermediates	1 if yes, 0 otherwise	14.0
Graduates and Above	1 if yes, 0 otherwise	10.4
Others	1 if yes, 0 otherwise	12.2
Family size	Continuous	
No. of Female Adults in family	Continuous	
Occupation		
Unemployed	1 if yes, 0 otherwise	12.0
Unskilled worker	1 if yes, 0 Otherwise	18.3
Skilled worker	1if yes, otherwise 0	10.3

Clerk/Office worker	1 if yes, 0 otherwise	10.9
Professional	1 if yes, 0 otherwise	11.4
Agriculture	1 if yes, otherwise 0	13.4
Self-Business	1 if yes, 0 otherwise	14.
others	1 if yes, 0 otherwise	9.7
Facility of Electricity		
Available	1 if Yes, 0 otherwise	88.0
Not Available	1 if yes, 0 otherwise	12.0
Facility of Gas		
Available	1 if Yes, 0 otherwise	65.7
Not Available	1 if Yes, 0 otherwise	34.3
Living Standard Index		
Very Poor	1 if yes, 0 otherwise	30.4
Poor	1 if yes, 0 otherwise	27.8
Non Poor	1 if yes, 0 otherwise	41.8

Source: Data used byUNDP survey of "Social Audit of Governance and Delivery of Public Services 2009-10 and 2011-12"

3.2.1 Gender:-

Previous studies (Clark and Oswald, 1986) indicate that women have greater level of satisfaction as compared to men, as women are largely responsible for fetching the drinking water.Abebawet.al (2011) argued in their study results that families with female heads are more inclined to use safe drinking water than families headed by man. Out of many reasons the author gave reason for this that females are more risk averted and in order to avoid water-borne health diseases as head they try to get improved water as decision makers of their families. The other reason might be in most of the areas of world females are responsible for water fetching and tries to go to improved water source no matter how far it may be.

3.2.2 Age of Household Head:-

According to study conducted by Nketiah-Amponsah (2009) reveals that although the relationship between ages of the household heads and ratio of obtaining improved water is statistically weak but the results shows that family headed by young households are obtaining improved water source as compared to families headed by

older heads. The level of satisfaction also increases as the age increases, that is, older individuals are more satisfied than young.

3.2.3 Education:-

Studies revealed that there is a positive relationship between education of household head and improved water source for drinking. As compared to illiterate heads the educated heads prefers to get drinking water from an improved water source and if there is no improved water source merely, they tries to minimize the adverse health effects of contaminated drinking water by many methods such as boiling, hauling etc. As far as satisfaction is concerned, the educated households as compared to uneducated households, shows less satisfaction for drinking water source, if they finds their drinking water unimproved, as they have knowledge about adverse effect of drinking contaminated and unimproved water.

3.2.4 No. of Adult Females in Family:-

The young girls are mainly responsible for fetching water for drinking and everyday use.A recent study by Abebaw 2011 said that according to a report by CSA in 2006 for fetching water from faraway places about 52% of population travelled half an hour or more. This long travelling adversely affect the health and time of female adults. Due to this reason most of the girls who are mainly responsible for fetching water find it difficult to give proper time to school in order to succeed in education. No. of adult females in family thus significantly affect the choice of drinking water.

3.2.5 Income of Household Head:-

Income of the household head is the most important socio-economic determinant of source and accessibility of drinking water. Unfortunately, we don't have income data, so we used roof structure, number of room's latrine type, in house and occupation of household head **as proxy for income**. All these factors combine by principle

component index form income index. It is expected that there exist a positive relationship between sources and accessibility of drinking water and income of household head that is, low income group tends to use unimproved and far away source of drinking water as compared to high income group, who uses improved water for drinking and will use tap into house or protected well or tube well in house.

3.2.6 Facility of Electricity and Gas:-

Facilities such as electricity and gas (in my thesis I just took gas and electricity) are supposed to have a positive relationship with source and accessibility of drinking water. As these facilities are basic needs for standard life. So it is expected that household who has facility of gas and electricity are considered to have possession of tap water inside their house which is considered as improved drinking water and the most nearby source of drinking water too.

3.2.7 Urban/ Rural:-

According to previous studies (Abebaw et al. 2011) access to improved drinking water is urban biased. Rural residents are less likely to have access to piped water in their residence. , public door tap and protected well. However, unprotected wells have expected positive association with rural residence .As far as quality of drinking water is concerned, urban dwellers are suffering much more than rural dwellers as they can't get improved water from their taps in their houses provided by the government, as in cities the drinking water facility is worse. Households have to bring water from water plants, as the tap water s contaminated and are not good for drinking. It may also be the reason that city people are more educated and aware of the adverse health effects of dinking polluted water.

3.2.8 Provinces:-

Same as socio-economic and demographic factors, geographic factors have strong and positive relationship with source and accessibility of drinking water. Province-wise, Pakistan is divided into four divisions namely Punjab, KP, Baluchistan and Sind. All these provinces are different from each other geographically. Punjab is land of fertile plain field, KP is mainly mountainous .Baluchistan consists of deserts and Sind has coastal areas and semi desert lands. Because of these geographical differences all these provinces differs in accessibility and thus quality of drinking water.

3.2.9 Water Source:-

As expected households using improved drinking water source such as tap into house, protected well and protected tube well in house are more satisfied than households using unimproved water sources such as unprotected well, rivers, lakes etc.

3.3 Methodology

The measurement and analysis of satisfaction has received increased research focus in various disciplines, including economics, public administration, psychology, and marketing. As indicated in Deichmann and Lall (2007), satisfaction can be modeled as a function of (1) citizens' prior anticipation of the performance of a product or service, and (2) the actual performance, as perceived by them. In other words, "expectation serves as an anchor to the evaluation of performance" (Deichmann and Lall 2007, 652).In applied research, measuring satisfaction with services is a difficult task. However, it is assumed to be potentially related to personal and economic characteristics such as age, gender, education, income, and wealth. Previous studies in economics indicate that women and older people have greater levels of satisfaction but that satisfaction levels strongly decline as the level of education increases (Clark

and Oswald 1996).Empirical studies of client satisfaction with public service delivery have received increased attention in recent years. For example, Van Ryzin's (2004) empirical work conforms to the model by Deichmann and Lall (2007), finding that citizen satisfaction with urban services is closely associated with the actual performance of the services versus citizens' initial expectations about these services.

In order to check for consumer satisfaction with drinking water supply sources. In particular, we focus on water quality and availability from the major drinking water sources used by households. As such, the dependent variables represent the degree to which respondents are satisfied with the availability and quality of the water they obtain from the main source. In this paper, drinking water sources are classified into two categories: improved water source and unimproved water source. A household is considered to have access to an improved water source if it gets drinking water primarily from a private standpipe, a public standpipe, and a protected spring, a dug well with a pump, rainwater, a water vendor, or a tank truck. Sources such as rivers, lakes, ponds, and unprotected wells are regarded as unimproved water sources.

In order to check for satisfaction of consumers with drinking water, we will be using Multinomial Logit Model, to analyze the dataset because the dependent variable is a categorical/choice variable satisfied with the drinking water as dependent variable.

The basic functions for can be written as

3.4 Models

In this study three models will be run ,details of which are as below.

3.4.1 Sources of Drinking Water:-

Sources of drinking water are divided into three categories

1) Optimal
2) Intermediate
3) Not improved

In General, the model for sources of Drinking water can be written as,

$$\text{Log}\frac{\Pr(Y=j)}{\Pr(Y=J')}=\alpha+\sum_{j=1}^{i=k}\text{BiXi}$$

Where

Y=Sources of drinking water

j= the identified source of drinking water

J'= the reference water source

Xi = the estimated regression co-efficient for each Xi factor

α = the regression intercept or constant

For the option of option of drinking water source, the MLM equation is

$$\text{Log}\frac{Pr(Y=source\ of\ drinking\ water)}{\Pr(Optimal)}=\beta0+\beta1(Gender)+\beta2(Edu)+\beta3(Adfem)+$$

$$\beta4(Income)+\beta5(Elect)+\beta6(Gas)+\beta7(Rururb)+\beta8(Pro)+Ui$$

3.4.2 Accessibility of Drinking water :-

Accessibility of drinking water is divided into three categories as below,

1) In house up to ¼ km from house
2) ¼ Km up to 1km from house
3) 1km up to 3 km from house

In General, the model for Accessibility of Drinking water can be written as,

$$\text{Log}\frac{\Pr(Y=j)}{\Pr(Y=J')}=\alpha+\sum_{j=1}^{i=k}\text{BiXi}$$

Where

Y= Accessibility to drinking water

j= the identified accessibility of household to drinking water

Xi = the ith factors

Bi = the estimated regression co-efficient for each Xi factor

α = the regression co-efficient for each xi factor

For the option of water accessibility, the MLM equation is

$$\text{Log}\frac{Pr(Y=accessibility\ to\ drinking\ water)}{\Pr\left(in\ house\ upto\frac{1}{4}km\ from\ house\ \right)}=\beta0+\beta1(Gender)+\beta2(Age)+\beta3(Edu)+$$

$$\beta4(Adfem)\ \beta5\ (Income)+\beta6\ (Elect)+\beta7\ (Gas)+\beta8\ (Rururb)+\beta9\ (Pro)+Ui$$

3.4.3 Consumer's Satisfaction:-

Consumers' satisfaction is divided into three categories as follows,

1) Satisfied
2) Not satisfied
3) Nor satisfied neither unsatisfied

In General, the model for Consumers' Satisfaction of Drinking water can be written as,

$$\text{Log}\frac{\Pr(Y=j)}{\Pr(Y=J')}=\alpha+\sum_{j=1}^{i=k}\text{BiXi}$$

Where,

Y = consumer's satisfaction with drinking water

j = the identified level of satisfaction

j'= the reference category of level of satisfaction

Xi = the ith factors

Bi = the estimated regression coefficient for each Xi factor

α= the regression intercept or constant

For the level of consumer's satisfaction, the MLM equation is

$$\text{Log}\frac{Pr(Y=consumer'ssatisfaction)}{\Pr(satisfied)} = \beta 0 + \beta 1(Gender) + \beta 2(Age) + \beta 3(Edu) +$$

$$\beta 4(Famsiz) + \beta 5(Occu) + \beta 6(income) + \beta 7(Elect) + \beta 8\text{Gas}t) + \beta 11(Gas) + \beta 9(Rururb)$$

$$+\beta 10(Pro) + \beta 11(watsour) + \beta 12(watavl) + Ui$$

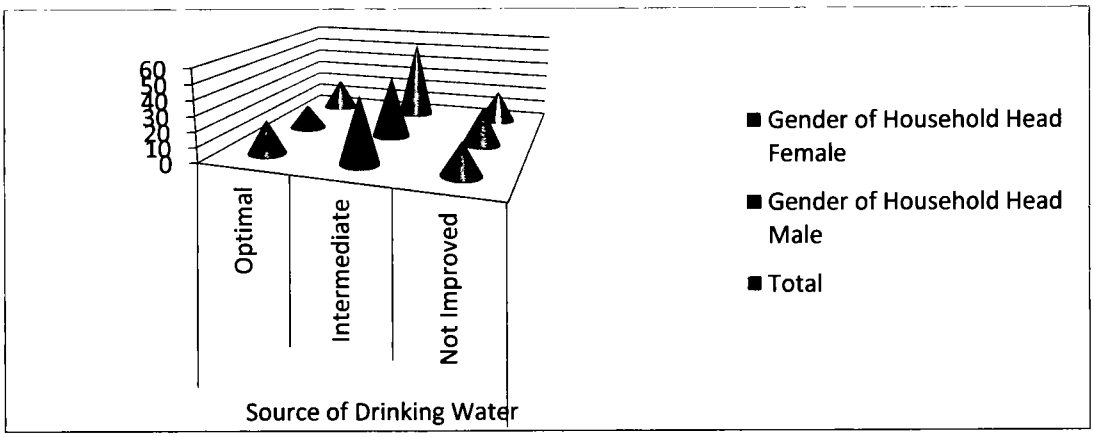
Chapter 4
Results and Discussions

This chapter discusses the analysis results and discussion, which is the mainstay of our study. As discussed in the previous chapter , The study will utilize UNDP household survey data collected by UNDP during its project "social audit of governance and delivery of public service 2009-10 and 2011-2012", by using Multinomial logistic regression model (MLM). According to objectives, it is divided into three sections and then into subsections according to need.

4.1 Descriptive Analysis

4.1.1 Sources of Drinking Water

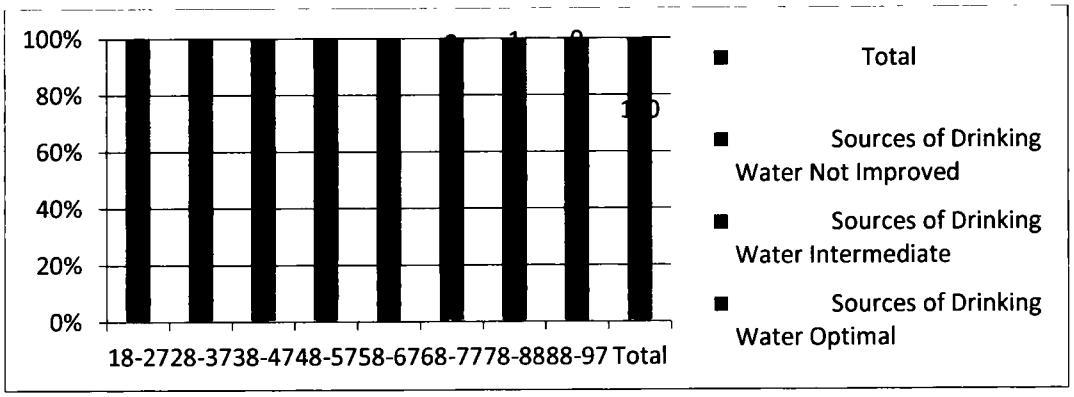
Figure 4.1.1 Age of household Head* Source of Drinking Water Cross Tabulation



In the above **Figure**.4.1.1 descriptive analysis of Gender and sources of drinking water is shown. It is assumed generally that male headed families use improved water sources. Contrary to our expectation, as the figures shows female headed families have a greater probability of using an improved source than do male-headed families.

In our results the percentage of female headed families who uses improved water source is 22.6 % as compared to 21.6 % of male headed families ,which is however low. As far as using unimproved water source is concerned, it is 16.6 % for female headed families and 25% for male headed families. Our results are similar as the study of Abebaw et.al 2011.in which they found that female headed families are more likely to use improved water source.

Figure 4.1.2 Age of household Head* Source of Drinking Water Cross Tabulation



In the above Figure 4.1.2 descriptive analysis of age of household head and sources of drinking water is shown. It is generally anticipated that age of the household head has a positive relationship with source of water that is young household are more energetic to fetch optimal and improved water even from distanced location as compared to old age household. But our analysis shows no such relationship between age of the household and source of drinking water. Which is clear from the table, for example household head between 18 to 27 years age 19.8% use optimal source and 24.3% use not improve source, but still at the very old age like 78 to 88 of the head 26.47% household use optimal source and 23.52% households use not improved source, but at the age of 88 to 97 of the head25% households use optimal source and 12.5% use not improved source. So our study does not support that age is an important factor determining household choice of using improved or optimal source.

Figure 4.1.3 Education of household Head* Source of Drinking Water Cross Tabulation

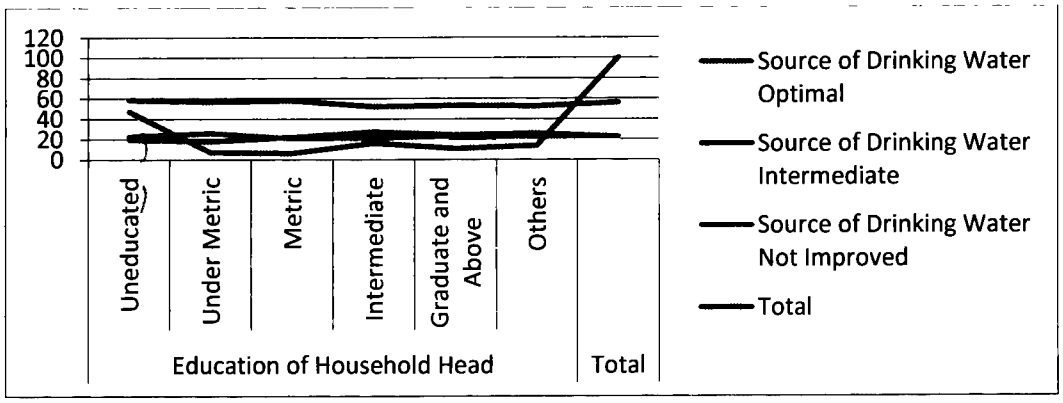


Figure 4.1.3 shows descriptive analysis for education of household heads and source of drinking water. It is generally expected that education of household head has a positive association with source of drinking water and our results also shows that educated household heads are more inclined to use improved water source. The descriptive analysis shows that 25% households with uneducated head use unimproved water source while 17.7% ,while it is 21.8 % for household head under metric who use improved water source and 20% who use unimproved water source, as the education level increases the household uses improved water source , as indicated in the above table. For household head whose education is intermediate 21.8 % use improved water source and 20 % use unimproved water source, for graduate level it is 24.1 % for improved water source and 22.2% for unimproved water source and for other education level the household uses 25.7% improved water source and only 22.2 % unimproved water source. These results clearly show that there is a positive relationship between education level of household head and use of improve water source.

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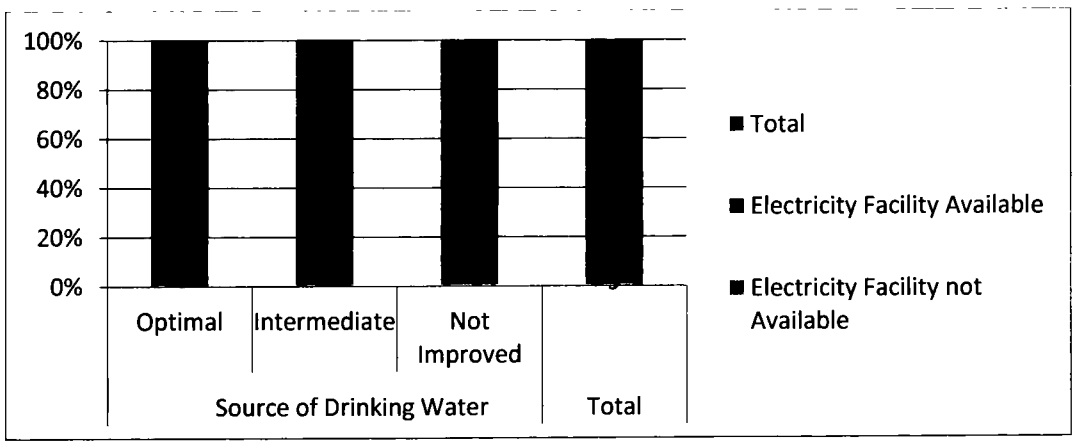
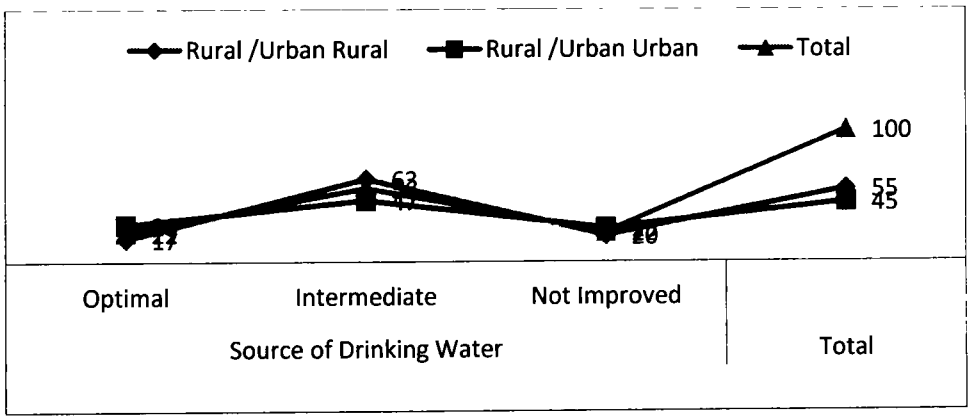
Figure 4.1.4 Electricity* Source of Drinking Water Cross Tabulation



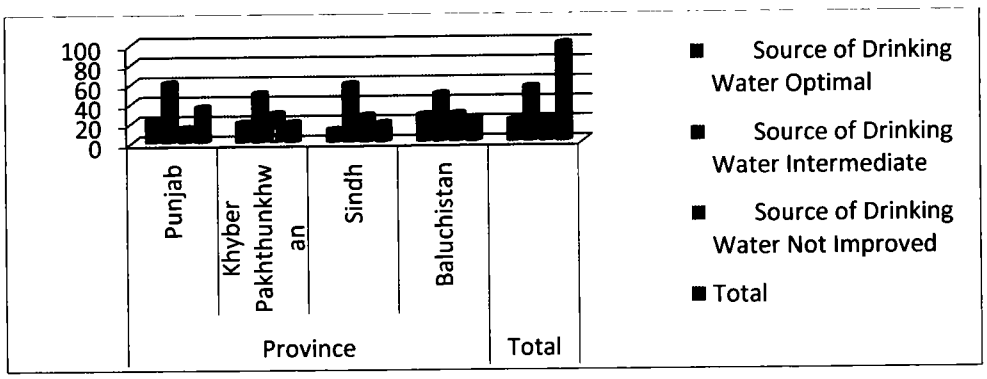
Facilities such as electricity and gas (in my thesis I just took gas and electricity) are supposed to have a positive relationship with source and accessibility of drinking water. As these facilities are basic needs for standard life. So it is expected that household who has facility of gas and electricity are considered to have possession of tap water inside their house which is considered as improved drinking water and the most nearby source of drinking water too. The information presented in the above figure 4.1.9show that only 12.4% household who does not has facility electricity use optimal source and 21.6% use not improved drinking water source. The percentage of household having facility of electricity that use optimal source is 23.5% and that of whom use not improved water source for drinking is 22.3%.The analysis shows that our study reflects the above statement that facility of electricity has a positive relationship with source of drinking water.

Figure 4.1.5 Rural/Urban * Source of Drinking Water Cross tabulation



According to previous studies (Abebaw et al. 2011) access to improved drinking water is urban biased. Rural residents are less likely to have access to piped water in their residence. , public door tap and protected well. However, unprotected wells have expected positive association with rural residence. Our study is in association with the previous studies, as figures in the above figure 4.1.5 shows that 17.2% of the rural dwellers use optimal source of drinking water and 26.0% use not improved drinking water source. In comparison of rural dwellers, urban dwellers are lucky enough as 28.1% use optimal source and 25.3% use not improved water source. Although the difference is not that big but our analysis however confirms that improved water is urban biased.

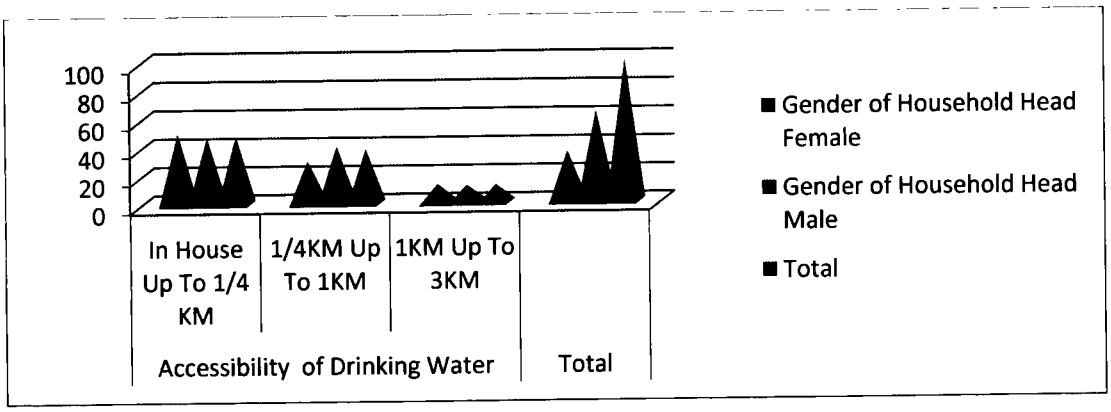
Figure 4.1.6Province * Source of Drinking Water Cross tabulation



Same as socio-economic and demographic factors, geographic factors have strong and positive relationship with source of drinking water. Province-wise, Pakistan is divided into four divisions namely Punjab, KP, Baluchistan and Sindh. All these provinces are different from each other geographically. Punjab is land of fertile plain field, KP is mainly mountainous .Baluchistan consists of deserts and Sind has coastal areas and semi desert lands. Because of these geographical differences all these provinces differs in accessibility and thus quality of drinking water. In Punjab 24.0% households use optimal while only 15% use not improved drinking water source. Coming towards KP, 20.3% use optimal and 29.5% use not improved water source. In Sindh, which is a semi desert province, only 13% use optimal and 27.3% use not improved source. Last but not the least, in Baluchistan, 28.0% use optimal and 22.8% use not improved water source.

4.1.2 Accessibility of Drinking Water

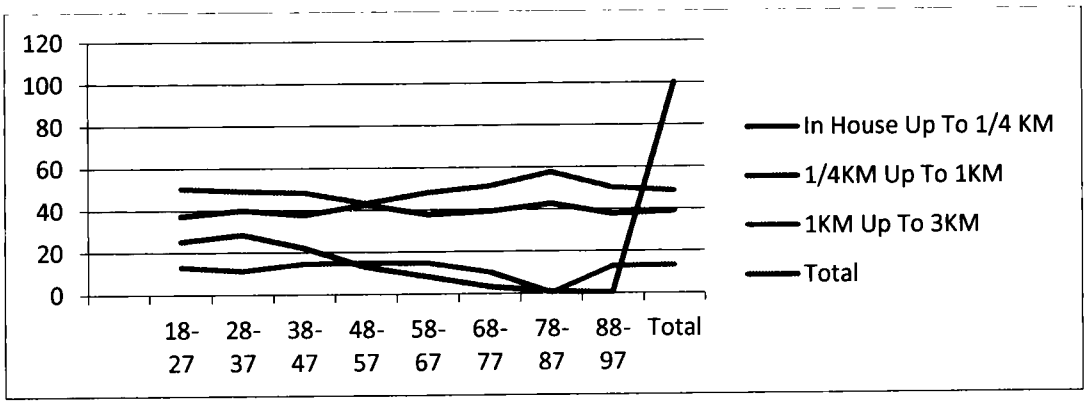
Figure 4.2.1 Gender of Household Head * Accessibility of Drinking Water Cross tabulation



In the figure 4.2.1 above the results indicates that female headed households have greater percentage of using an improved water source that is "In house up to ¼ Km" with 50.6% ,which is higher than male headed households with 47.2%. Several reasons may be there for this result. But the main reason which is also given in previous studies such as "Abebaw 2011" that women are more risk-averted than men

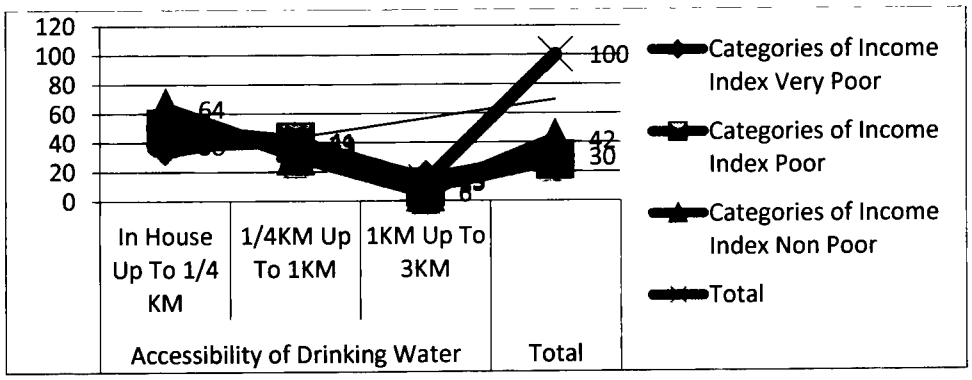
and hence want to curtail water-related diseases by choosing improved water source. In the table it is indicated that again percentage of female-headed families with 13.5% is higher than male-headed families with 12.4%, whose accessibility to drinking water is "1 Km up to 3 Km". Again the possible reason for this can be given that "Women are mainly responsible for fetching water from far-away places and if they are decision makers too, they tries their best to fetch clean water for drinking ,even from far-away places (Abebaw 2011).

Figure 4.2.2 Age of Household Head * Accessibility of Drinking Water Crosstabulation



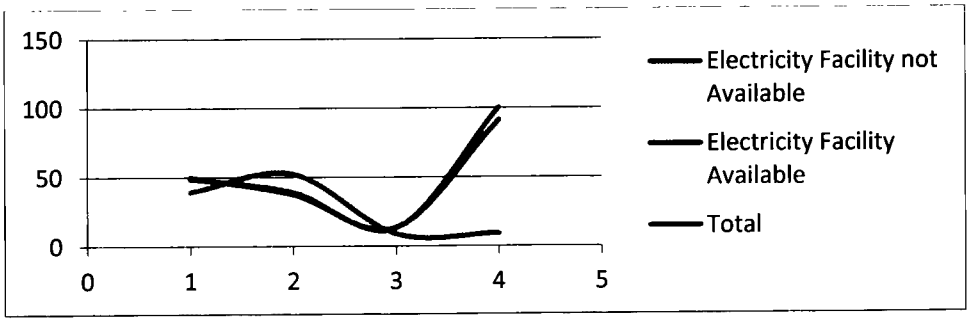
In figure 4.2.2 accessibility of drinking water with respect to age of household heads is shown. The table indicates that there is a positive relationship between age of household head and accessibility of drinking water that is as age of the household increases he tends to use nearby water source "In house up to ¼ Km" in my thesis. For example, when household head age is 18-27 the percentage of "in House up to ¼ km" is 50.2% while "1/4 km up to 1km" is 36.9% and only 12.8% "1km up to 3km"

Figure 4.2.3Categories of Income Index * Accessibility of Drinking Water Cross tabulation



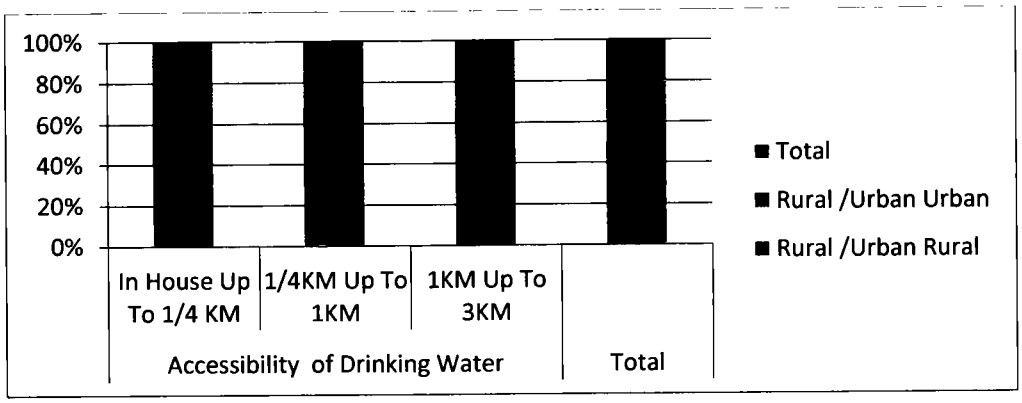
Income of household head and accessibility to drinking water source has a very positive relationship. That is, when income of the household head increases, his accessibility to drinking water source improves. The explanation for the above statement might be that, when income of household head increases it clearly means that the family's standard of living is also becoming high and they are now getting "in house" water source for drinking with other household needed stuff. In my thesis I used income as proxy by taking fur components (i) Latrine Type (ii) Roof Structure (iii) Occupation of the Household Head and (iv)No. of rooms in house by using Principle Component Index. Therefore, the income proxy thus generated clearly tells standard of living of a family. From the above table we can see that when a person is very poor with low income the only 38.3%, households have access to "in house up to 1/4km" water source, which means that very poor household use impure drinking water that is "1km up to 3km' the percentage is 14.6%.. But when we see at accessibility of poor household to drinking water source, who are although poor but somehow earn more income than very poor households, 50.1% household have access to "in house up to 1/4km" drinking water source which increases more further to 63.5% with noon poor households. While using "1km up to 3km" water source decreases to only 5.6%.

Figure 4.2.4Electricity * Accessibility of Drinking Water Crosstabulation



Facilities such as electricity and gas are supposed to have a positive relationship with accessibility of drinking water. As these facilities are basic needs for standard life. So it is expected that household who has facility of gas and electricity are considered to have possession of tap water inside their house which is considered as the most nearby source of drinking water. The information presented in the above table 4.2.6show those 39.1% households who do not have electricity facility use "in hose up to 1/4km" source for drinking water and 52.1% use "1/4k up to 1km"drinking water source. The percentage of household having facility of electricity that use 'in house" source is thus greater with 49.3% and that of using "1/4km up to 1km"water source for drinking is less with 37.3%. The analysis shows that our study reflects the above statement that facility of electricity has a positive relationship with accessibility of drinking water.

Figure 4.2.5 Rural /Urban *Accessibility of Drinking Water Cross tabulation



According to previous studies of Abebaw et.al (2011) "access to improved drinking water is urban biased. Rural residents are less likely to have access to piped water in their residence, public door tap and protected well. However, unprotected wells have expected positive association with rural residence." Our study is in association with the previous studies, as figures in the above table 4.2.5 shows that 44.3% of the rural dwellers use "In house' source of drinking water and 48.8% use "1/4km up to 1km" drinking water source. In comparison of rural dwellers, urban dwellers are lucky enough 53.4% use "in house" and 32.3% use "1/4km up to 1km" drinking water source.

Table 4.2.6Province * Accessibility of Drinking Water Cross tabulation

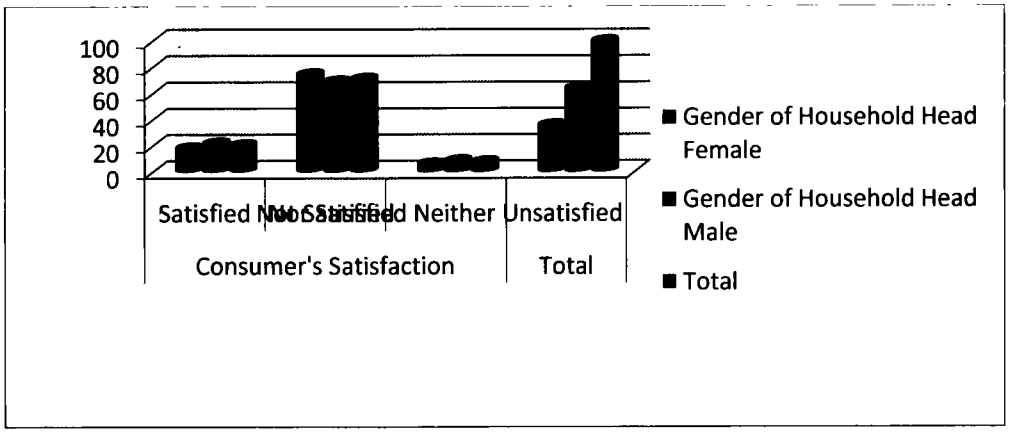
		Accessibility of Drinking Water			Total (%)
		In House Up To 1/4 KM (%)	1/4KM Up To1KM (%)	1KM Up To 3KM (%)	
Province	Punjab	46	39	15	36
	Khyber Pakhthunkhwa	49	39	12	20
	Sindh	56	28	11	20
	Baluchistan	45	43	12	24
Total		48	39	13	100

Same as socio-economic and demographic factors, geographic factors have strong and positive relationship with source of drinking water. Province-wise, Pakistan is divided into four divisions namely Punjab, KP, Baluchistan and Sindh. All these provinces are different from each other geographically. Because of these geographical differences all these provinces differs in accessibility and thus quality of drinking water. In Punjab 46.1% households use "in house" while 38.5%% use "1/4km up to 1km" drinking water source. Coming towards KP, 49.2%% use "in house' and 38.8% use '1/4km up to 1km" water source. In Sindh, the ratio is highest at 55.8% who use "in house" and 28.3% who use "1/4km up to 1km" drinking water source. Baluchistan is the lowest in "in house" drinking water source with 45.2% % and highest in using

"1/4km up to 1km" source for drinking water. The descriptive analysis also indicates that percentage of not satisfied households is fairly more than satisfied household in all cases. The reason in case of "Optimal" sources most probably is that tape water supply in urban areas is considered not to be good enough for drinking in cities. According to Jillani (2008) "The gravity of the water-supply situation in the country necessitates immediate steps and a permanent resolution. The problem threatens the entire nation but large cities being centers of power, and more vocal, attract more attention. Karachi, Hyderabad, Faisalabad, Multan, Peshawar, Quetta, Lahore and Islamabad/ Rawalpindi are the worst-hit cities and little is done to ameliorate their problems on a sustainable basis.

4.1.3 Consumer's Satisfaction

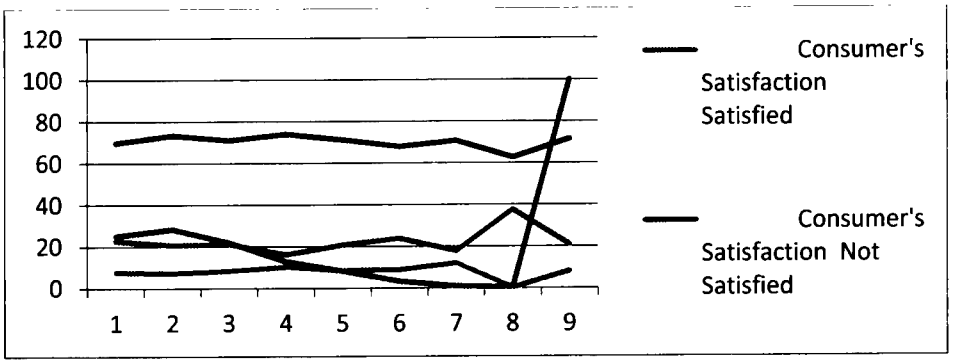
Figure4.3.1 Gender of Household Head * Consumer's Satisfaction Cross tabulation



As far as satisfaction of household head with quality and availability is concerned, according to Abebaw (2011), females are more risk averse than males. The reason they give is as females are mainly responsible for fetching water and children upbringing, so , in order to avoid health issues cause by poor water quality , they tries to opt clean drinking water sources no matter far or near. Our findings also shows that if satisfaction level is measured compare to 22.0% males only 18.5% females are

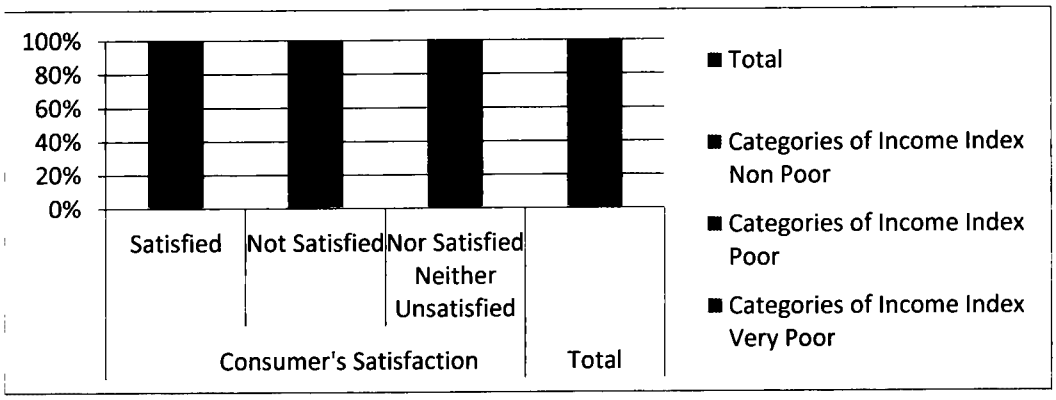
satisfied from their drinking water source whereas large no. of females comprised of 74.8% are not satisfied from drinking water source they are using.

Figure 4.3.2Age of Household Head * Consumer's Satisfaction Crosstabulation



From the above table it is crystal clear that age has a negative relationship with the satisfaction level of consumers with water they drink. It is as when age increases satisfaction level decreases and they tend to be more unsatisfied with age, but it is not the case with old people. The data shows that when a person becomes old enough his satisfaction level gets higher, the reason more obvious is that old people are weak enough to travel long distance to fetch water from far away or even nearby places, so they usually are satisfied with water they gets at home or near home. In the table 22.3% of household head are satisfied with drinking water as compared to 69.6% who are unsatisfied between 18-27 years of age. But satisfaction level decreases to 20.3% when the household head reaches the age between "28-37'. It further decreases to 16.0% when household head reaches to 48-57 years, when he is most powerful in his lifetime and in fact have gained experience and awareness about harmful effects of drinking contaminated and not improved water. So he tries to get improved water, even if he has to get it from faraway source. In the table above we can see that when the household head reaches to age 88-97 his satisfaction level increases to 37.5%, which justifies the above mentioned statement that " when a person becomes old enough his satisfaction level gets higher'' and vice versa.

Figure 4.3.3 Categories of Income Index * Consumer's Satisfaction Cross tabulation



Income of household head and satisfaction with drinking water has a very positive relationship. That is, when income of the household head increases, he tends to be more satisfied with drinking water he uses. The explanation for the above statement might be that, when income of household head increases it clearly means that the family's standard of living is also becoming high and they are now getting improved water for drinking with other household needed stuff. In our thesis we use income s proxy by taking fur components (i) Latrine Type (ii) Roof Structure (iii) Occupation of the Household Head and (iv)No. of rooms in house by using Principle Component Index. Therefore, the income proxy thus generated clearly tells standard of living of a family. From the above table we can see that when a person is very poor with low income the satisfaction level is only 14.4%, which means that very poor household use impure drinking water. But when we see at satisfaction level of poor household, who are although poor but somehow earn more income than very poor households, the satisfaction level of the said households is 17.5, which increases more further to 27.5% with noon poor households. From the table above it is cleared now that satisfaction of households has positive relationship with income of its household head.

Figure 4.3.4Electricity * Consumer's Satisfaction Cross tabulation

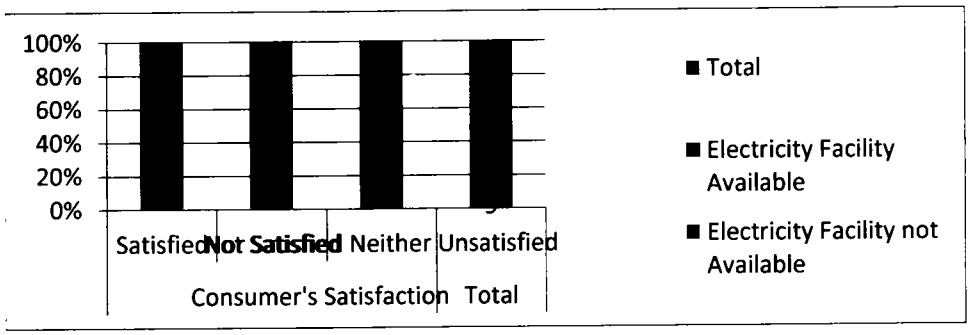
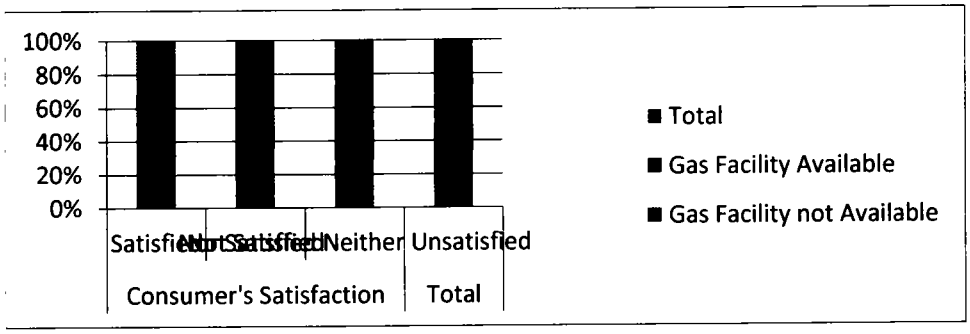


Figure 4.3.5 Gas * Consumer's Satisfaction Cross tabulation

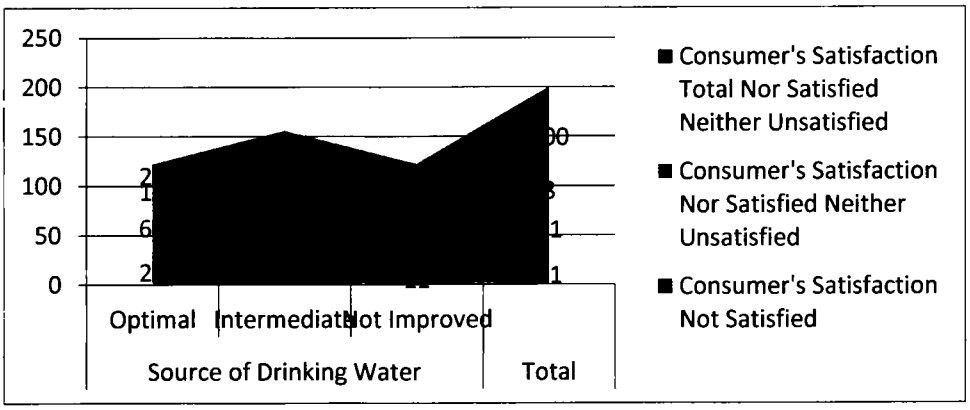


As said earlier facilities like electricity, Gas, Transportation, Education, Health and other like these are best determinants of household standard of living. In my thesis, I used electricity and Gas as facilities provided to household to analyze their level of satisfaction with drinking water they use. These both determinants are also used in many previous researches include Amponsah (2009) and Abebaw (2011) to find out user's satisfaction level with drinking water. Our results match with both of the mentioned researches that is facility of Gas has positive relationship with Drinking water. It is as if household have facility of Gas they are more satisfied with Drinking water they use than those who do not have the facility. Therefore, we can say that there is a positive relationship between Consumer's satisfaction with of Drinking water and facility of Gas. It is clear from the above table 4.3.5 that when facility of Gas is not available only 17.9% people were satisfied with drinking water they were using and 73.8% were not satisfied, but when facility was available the percentage of

satisfied households with drinking water increased to 26.1% and those of unsatisfied household decreased to 66.2%

From the table 4.3.5 above we can clearly see that households who use "In house up to ¼ Km" drinking water source with 25.5% are more satisfied than those who uses other drinking water sources "1/4 Km up to 1 Km" are 14.8% and those using " 1Km up to 3Km" are 20.4% satisfied with their drinking water source.

Figure 4.3.6 Source of Drinking Water * Consumer's Satisfaction Cross tabulation



If we see at the descriptive analysis figure 4.3.6 , we will clearly see that households using "Optimal" water source are more satisfied with 26.0% as compared to other two water sources "Intermediate" with 22.4% and "Not Improved" with only 11.3%. The descriptive analysis also indicates that percentage of not satisfied households is fairly more than satisfied household in all cases. The reason in case of "Optimal" sources most probably is that tape water supply in urban areas is considered not to be good enough for drinking in cities. According to Jillani (2008) "The gravity of the water-supply situation in the country necessitates immediate steps and a permanent resolution. The problem threatens the entire nation but large cities being centers of power, and more vocal, attract more attention. Karachi, Hyderabad, Faisalabad, Multan, Peshawar, Quetta, Lahore and Islamabad/ Rawalpindi are the worst-hit cities and little is done to ameliorate their problems on a sustainable basis".

Figure 4.3.7 Rural/Urban* Consumer Satisfaction Cross tabulation

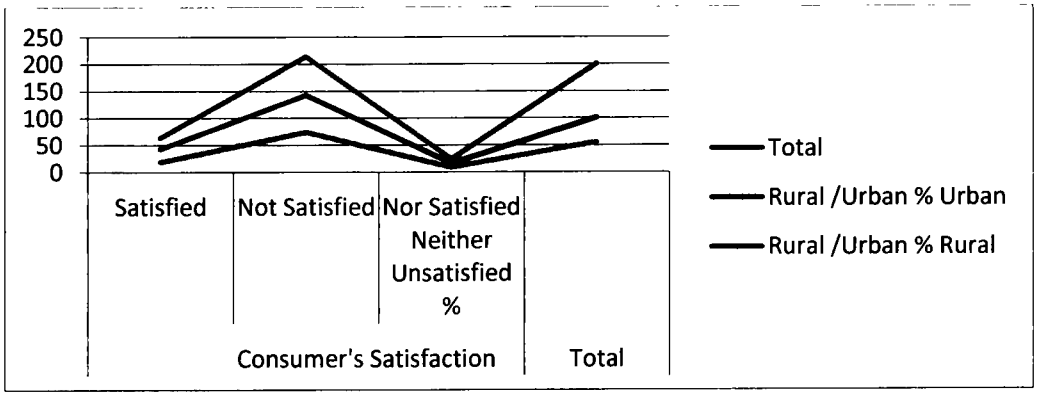
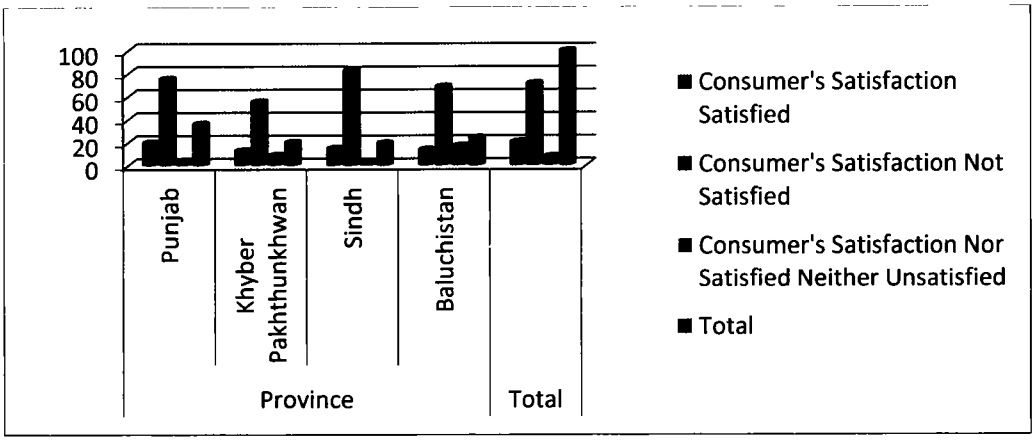


Figure 4.3.7 above showing Consumer's satisfaction with drinking water via urban and rural division. The results indicate that urban dwellers are more satisfied with the water they drinks with 24.1 % and rural dweller however with 18.0% are less satisfied. There might be several reasons for this difference but the most stated is in urban areas like other facilities drinking water accessibility and quality is tried to be made good enough. But when we see at the table again and match the results, we finds that probability of unsatisfied dwellers with 73.6% and 68.2% is far more than satisfied ones both for urban and rural respectively. This is an alarming indicator for Pakistan's policy makers that in Pakistan the quality of drinking water needed to be improved extensively.

Figure 4.3.8 Province* Consumer's Satisfaction Cross tabulation



In figure 4.3.8 consumer's satisfaction is shown by provincial division. Punjab stands at the highest with 20.0% followed by Sindh with 15.0%. Baluchistan stands third

with 14.0% while KP with 13.0% stands at the lowest satisfaction rate. But unfortunately, when we look at the un-satisfaction level, we see that percentage of un-satisfied consumers is much higher than satisfied ones. Sindh is at the job with alarming 82.8% followed by Punjab, Baluchistan and KP with 75.3%, 68.7% and 55.4% respectively. Overall, 71.2% households are not satisfied with drinking water quality. Which is as said earlier a biggest challenge for Pakistan government and policy makers.

4.2 Regression Analysis

4.2.1 Regression Analysis (Socio-economic Determinants of Sources of Drinking Water)

Under the multinomial logistic regression analysis, we run three models to determine the factors significant in sources and availability of safe drinking water; Out of these three regressions the First and second model specifies the main determinants of sources of drinking water and availability of drinking water respectively. The Third model shows factors that determine users' satisfaction with availability and source of drinking water they use.

Table 4.2.1 Presents probability estimates of Multinomial Logit model. It is worth to note that optimal source of drinking water is utilized as the reference category in the model estimation.

Table 4.2.1 Socio Economic Determinants of Sources of Drinking Water

	Intermediate	OR	Not Improved	OR
Family size	0.021* (0.011)	1.021	-0.027** (0.013)	0.974
No. of Rooms in House	-0.103* (0.026)	0.902	-0.005* (0.029)	0.995
Female	-0.021* (0.087)	1.789	-0.534* (0.107)	0.586
Very Poor	-1.262** (0.116)	0.865	-0.033** (0.0889)	0.967
Poor	-0.431** (0.112)	0.283	0.270** (0.096)	1.310
Outside the House	0.638* (0.110)	1.893	0.620* (0.126)	1.859
Facility of Gas	-0.145*** (0.097)	0.865	0.400** (0.120)	1.492
Rural	0.583* (0.083)	1.791	(0.079 (0.100)	0.924
Punjab	0.907* (0.115)	0.733	90.422* (0.141)	1.526

Sindh	0.901* (0.129)	0.361	-0.122* (0.147)	3.070
Khyber Pakhtunkhwa	0.838* (0.144)	0.301	1.180* (0.162)	3.255

Note: The comparison group is optimal source

OR = Odds ratio

Standard Error (SE) in Parentheses

*P = 0.05, **P = 0.01 and ***P = 0.1

-2log likelihood = 521.542

LR Chi ^{2}(38) = 675.722(38)

Prob> 0.000

Using the likelihood ratio test, the overall strength of association predicted for this model across the various choices is 0.000 which is significant at 5% significant level. The chi square of this model is 675.722(38). Initially demographic and socio-economic factors such as age, gender, education, no. of female adults in family, income of HHH , rural/urban and province were included in the model in order to know about the main determinants of sources of drinking water in Pakistan. The regressed model shows that out of the above factors some of the factors are highly significant in determining the sources of drinking water used by the households. These factor includes family size, gender of the household head, income of household head and province. Details of the factors independently are as below.

Our results for family size coherent with Abebaw*et.al* 2011 i.e. smaller the size of a family improved sources it will use. It is clear that family size has a very significant relationship with sources of drinking water. If a family size were to increase their water quality test by one unit, the relative risk for intermediate water quality relative to optimal water quality would be expected to increase by a factor of 1.021 given the other variables in the model are held constant which means that small family tend to

use improved water source than large family size.It is generally perceived that smaller the family size, richer the household is. As small family shows that dependency ratio is low and per capita expenditure of the household is high and the household is living a standard life, with every facility available to them, compared to a bigger household size with the same income.

The study of Abebaw et.al 2011 concluded that contrary to general anticipation, female headed household have greater probability of using an improved drinking water source then male-headed families. There may be several reasons for this result. First, women, along with children are main persons responsible for fetching water for drinking and other domestic chores, and as heads and decision makers, they may be more inclined to invest in the effort of fetching improved water. Second, as studies elsewhere indicate, women are more risk-averse than men and hence want to minimize water-borne illness by using improved source of water available to them. However, in our regression analysis, for females relative to males, the relative risk for intermediate water quality relative to optimal water quality would be expected to increase by a factor of 1.789 given the other variables in the model are held constant.

Asante (2003) found that there exists a significant statistical relationship between income and drinking water source. However our results are rational with Osei-Asare (2005) who found a significant inverse relationship between income and source of drinking water. It is generally accepted that as income of the household become better the household use of improved water source increases and households tends to use optimal and intermediate source of drinking water which in our case are pipe into dwelling, bottle water, well into dwelling and street, tube well into dwelling and street. However, in our regression analysis, for very poorwith odd ratio of 0.865 and 0.967 the relationship with intermediate and not improved is negative as compared to

non-poor who use optimal source. While for poor the odd ratio for intermediate over optimal is negative with 0.283 and positive for not improved with odd ratio of 1.310.

Facilities such as electricity and gas (in my thesis I just took gas and electricity) are supposed to have a positive relationship with source of drinking water. As these facilities are basic needs for standard life. So it is expected that household who has facility of gas and electricity are considered to have possession of tap water inside their house which is considered as improved drinking water and the most nearby source of drinking water too. My result reveals that that gas is significant while electricity has no relation with source of drinking water. The relationship of facility of gas with intermediate source is negative with odd ratio of 0.865and not significant while for not improved source it is positive and significant with odd ratio 0.400, which means that as facility of gas improves the source of drinking water also improves.

Our results for Rural urban divisions contradicts with the findings of Amponsah (2005) who found that drinking water source is an optimal source of drinking water is urban biased , rural dwellers are less likely to use optimal water source. In our results the odd ratio of rural area dwellers is 1.791 in favor of intermediate source of drinking water over optimal drinking water source while holding other variables remain constant that means that rural dwellers use intermediate source of drinking water .One of the reasons might be that that in Pakistan the water quality of piped water into dwelling in major cities such as Islamabad, Karachi, North Nazimabad is not good for drinking and people use to fetch water from the nearby water plants.

Same as socio-economic and demographic factors, geographic factors have strong and positive relationship with source and accessibility of drinking water. Province-wise,

Pakistan is divided into four divisions namely Punjab, KP, Baluchistan and Sindh. All these provinces are different from each other geographically. Punjab is land of fertile plain field, KPK is mainly mountainous .Baluchistan consists of deserts and Sindh has coastal areas and semi desert lands. Because of these geographical differences, all these provinces differ in accessibility and thus quality of drinking water. Our result shows that in Pakistan, the relationship of sources of drinking water is positive and highly significant with geographical boundaries. From the table above although there is a significant relationship between sources of drinking water and provinces but the association is strongest in Punjab with not improved water source and lowest in KP.

4.2.2 Regression Analysis (Socio-economic Determinants of Accessibility of Drinking Water)

The results of multinomial logistic regression analysis of the model for accessibility of drinking are indicated in the following table 4.2.2. It is worth mention that "In house up to 1/4km" is used as reference category.

Table 4. 2.2 Socio Economic Determinants of Accessibility to Drinking Water

	1/4Km upto 1Km	OR	1Km up to 3Km	OR
No. of Rooms	0.103*	1.109	0.108**	1.114
	(0.000)		(0.001)	
Family size	0.10**	1.106	0.08	1.087
	(0.020)		(0.03)	
Uneducated	(0.134		0.393**	
	(0.110)	0.875	(0.160)	1.482
Under Metric	(0.345*		0.323***	
	(0.162)	0.708	(0.222)	1.382
Metric	-0.082		0.207	
	(0.163)	0.922	(0.230)	1.23
Intermediate	-0.116		-0.112	
	(0.123)	0.891	(0.183)	0.894
Graduate and Above	-0.167		-0.387***	
	(0.136)	0.847	(0.214)	0.679
Very Poor	0.801**		-0.112**	
	(0.117)	2.228	(0.121)	2.592
Poor	0.855**		-0.387**	
	(0.125)	2.351	(0.128)	3.019
Gas not Available	0.426*	1.531	0.269	1.309
	(0.119)		(0.206)	
Electricity not Available	-0.016	0.985	0.318*	1.375
	(0.085)		(0.121)	
Rural	0.466*	1.594	0.280**	1.323
	(0.070)		(0.100)	
Punjab	-0.100	0.905	-0.170*	0.844
	(0.097)		(0.143)	
Sindh	0.045	1.046	-0.450*	0.638
	(0.106)		(0.163)	
Khyber Pakhtunkhwa	-0.392*	0.676	-0.285*	0.752
	(0.110)		(0.168)	

Note: The comparison group is "In House Up to 1/4km".

OR = Odds ratio

Standard Error (SE) in Parentheses

*P = 0.05, **P = 0.01 ***P =0.1

-2log likelihood = 7.936

LR Chi ^{2}(48) = 404.107 (84)

Prob> 0.000

In the model fitting information show Chi square test is 404.107 (84) and the likelihood ratios test is at significant level of 5% which is 0.000. For accessibility of drinking water the model shows that socioeconomic and demographic factor (such as age, sex and income) are statistically significant.

The result in the above table 4.2.2 shows that income, education level, facility of gas, and location such as rural urban residence are significant factors in determining accessibility of drinking water to the households. Some other factors such as education and occupation as expected to have significant relationship determining households' accessibility to drinking water as in previous studies such as Asente(2003), Iskandarani (2002) and Osei-Asare (2005) who established a significant relationship between these factors with accessibility are also significant in our study.

Previous studies done by Abebaw (2011) and Amponsah (2005) established a significant relationship between Education and accessibility of drinking water. They found that as the education level of household head increases the occupation and thus standard of living of household get improves and they gets in house accessibility of drinking water. Our study however finds that only Uneducated and under metric level of education has significant relationship with accessibility of drinking water, which is negative for "1/4km up to 1km" and negative for "1km up to 3km" accessibility of water source. The odd of uneducated is 1.082 times in favor of accessibility of

drinking water from 1km up to 3km over 1/4km up to 1km as compared to other level of education.

Income of household head which is taken as proxy of income in our study plays a significant role in household accessibility to drinking water. From the study of Person (2002) found that occupation level does not have significant effect on household demand for in house source increases. The study of Abebaw (2011) and Amponsah (2005) however found that there exists a significant relationship between the two variables.Income of the household head is the most important socio-economic determinant of accessibility of drinking water. Unfortunately, we didn't had income data, so we used roof structure, number of rooms, latrine type and occupation of household head **as proxy for income**. All these factors were combine by **principle component index** form income index. It is expected that there exist a positive relationship between income of household head and accessibility that is, low income group tends to have no accessibility of "in house water source" as compared to high income group, who uses use tap into house or protected well or tube well in house.The odd for very poor is 2.224 in above (mentioned table). It means very poor people are likely to have "1/4km up to 1km" accessibility of water source as compare to non-poor people who use "in house up to 1/4km" water source. The odd of poor income group in favour of "1km up to 3km" accessibility of water 3.019times over "in house 1/4km" compared to the non-poor income group.

Facilities such as electricity and gas are supposed to have a positive relationship with accessibility of drinking water. As these facilities are basic needs for standard life. So it is expected that household who has facility of gas and electricity are considered to have possession of tap water inside their house which is considered as the most nearby source of drinking water. The information presented in the above table 4.3.2

show that there is a positive relationship between facility of gas and electricity not available and access to far away sources of drinking water with odd ratios for facility of gas not available are 1.267 and 1.375 times greater in favor '1/4km up to 1km" and '1km up to 3km respectively which means that households who don't have gas facility available to them in house they also do not have "in house 'accessibility in their houses. However for not availability of electricity in house the relationship is negative in favor of "1/4km up to 1km" with an odd ratio of .985 but the relationship is not significant at all.

According to previous studies such as Abebaw et al. (2011) access to improved drinking water is urban biased. Rural residents are less likely to have access to piped water in their residence, public door tap and protected well. However, unprotected wells have expected positive association with rural residence." Our study is in association with the previous studies as the odd ratios shows perfectly positive relationships between rural residence and their accessibility to drinking water from "1/4km up to 1km" and "1km up to 3km" as compared to accessibility of urban dweller to drinking water source from 'in house up to 1/4km" . The odd ratio of rural dwellers is 1.627 times greater in favor of "1/4km up to 1km" over 'in house up to 1/4km" while holding other things constant. The odd ratio of rural in favor of "1km up to 3km" is 1.339 times greater over "in house up to 1/4km" category of accessibility of drinking water as compared to the urban resident.

Pakistan is divided into four divisions namely Punjab, Sindh, KP and Baluchistan. All these provinces are different from each other geographically. Because of these geographical differences all these provinces differs in accessibility and thus quality of drinking water. But contrary to our a priori expectations the findings from our study

reveals that there is actually negative relationship between all provinces in both "1/4km up to 1km" and "1km up to 3km categories of accessibility of drinking water as compared to "in house up to 1/4km" category. However the odd ratio Sindh is 1.046 times greater in favor of "1/4km up to 1km" category over "in house up to 1/4km" which means that in Sindh households have a propensity to have accessibility of drinking water source from 1/4km up to 1km as compared to "in house up to 1/4km".

4.2.3 Regression Analysis (Socio-economic determinants of Consumer's satisfaction from Drinking water)

The results of multinomial logistic regression analysis of the model for accessibility of drinking are indicated in the table below. It is worth mention that "Satisfied" is used as reference category.

Table 4.2.3 Socio Economic Determinants of Consumers Satisfaction

	Not Satisfied	OR	NSNU	OR
Age of HHH	0.004	1.004	0.008*	1.008
	(0.003)		(0.004)	
Female	0.197*	1.217	0.224***	1.251
	(0.086)		(0.146)	
Electricity Not Available	0.798*		0.053	
	(0.189)	2.220	(0.306)	1.054
Optimal	-1.054*	0.349	-0.271	0.763
	(0.137)		(0.227)	
Intermediate	-0.923*	0.397	-0.099	0.905
	(0.119)		(0.196)	
In House up to 1/4Km	-0.373*	0.688	-0.678*	0.508
	(0.121)		(0.193)	
1/4Km up to 1Km	0.306	1.357	-0.118	0.889
	(0.130)		(0.201)	
Very Poor	0.600*	1.823	0.631*	1.879
	(0.104)		(0.177)	
Poor	0.408*	1.504	0.680*	1.974
	(0.100)		(0.162)	
Punjab	-0.044	0.957	-1.487*	0.226
	(0.116)		(0.182)	
Sindh	-0.979*	0.376	-1.391*	0.249
	(0.119)		(0.172)	
Khyber Pakhtunkhwa	0.154*	1.166	-1.861	0.155
	(0.142)		(0.268)	

Note: The comparison group is the Satisfied.

NS = Not Satisfied

NSNU= Not Satisfied Neither Unsatisfied

OR = Odds ratio

Standard Error (SE) in Parentheses

*P = 0.05, **P = 0.01 and ***P = 0.1

-2log likelihood = 521.542

LR Chi ^{2}(24) = 607.456 (24)

Prob> 0.000

In the model fitting information show Chi square test is 503.542 (16) and the likelihood ratios test is at significant level of 5% which is 0.000. For consumer's satisfaction, the model shows that socioeconomic and demographic factor (such as age, sex and income), accessibility and source of drinking water are statistically significant.

One of the main determinants which come in the way of satisfaction level is age of HHH. When household head reaches to older age he in fact have gained experience and awareness about harmful effects of drinking contaminated and not improved water. So he tries to get improved water, even if he has to get it from faraway source. In our regression, If age were to increase to test satisfaction criteria by one unit, the relative risk for not satisfied relative to satisfied would be expected to increase by a factor of 1.004 given the other variables in the model are held constant. As per a priori expectations which our study confirms, It is as when age increases satisfaction level decreases and they tends to be more unsatisfied with age.

Previous studies (Clark and Oswald, 1986) indicate that women have greater level of satisfaction as compared to men, as women are largely responsible for fetching the drinking water. So in our model, there is also gender impact on the satisfaction level. The results show that the females relative to male would be expected to increase not satisfaction by factor 1.217 given other variables in the model constant. It means that women are more conscious about the water quality.As far as satisfaction of household

head with quality and availability is concerned, according to Abebaw(2011), females are more risk averse than males. The reason they give is as females are mainly responsible for fetching water and children upbringing, so , in order to avoid health issues cause by poor water quality , they tries to opt clean drinking water sources no matter far or near. Our findings also demonstrate that the above mentioned sentence is true in favor of not satisfied over satisfied category which means that females are not satisfied from drinking water source they are using as compared to men.

Facilities such as electricity are supposed to have satisfaction level of consumer. As these facilities are basic needs for standard life. So it is expected that household who has facility of electricity are considered to have possession of tap water inside their house which is considered as improved drinking water and the most nearby source of drinking water too and thus to be satisfied with his drinking water. Our study is coherent with study of Abebaw (2011) which depicts as compared to facility available to household the one who do not have facility of electricity. If a household were to increase electricity connection to test satisfaction by one unit, the relative risk for not satisfied relative to satisfied would be expected to increase by a factor of 2.22 given the other variables in the model are held constant.

If we see at results in table 4.2.3, we will clearly see that households using "Optimal" and "Intermediate" water source are less satisfied as compared to "Not Improved "water source. The analysis indicates that households using "Optimal source are 0.349 times less likely to be not satisfied with drinking water source as compared to satisfied consumers who use not improved source .If households who use optimal water and intermediate level were to increase by one unit, the relative risk for not satisfied relative to satisfied would be expected to decrease by a factor of 0.349 and 0.397 respectively given the other variables in the model are held constant. If we

see the odd ratio of "nor satisfied neither unsatisfied" category which is 0.763 shows that if there is one unit change in satisfaction under availability, there would be expected to decrease by factor of 0.763 times relative to satisfied who use not improved source .According to Jillani (2008) "The gravity of the water-supply situation in the country necessitates immediate steps and a permanent resolution. The problem threatens the entire nation but large cities being centers of power, and more vocal, attract more attention. Karachi, Hyderabad, Faisalabad, Multan, Peshawar, Quetta, Lahore and Islamabad/ Rawalpindi are the worst-hit cities and little is done to ameliorate their problems on a sustainable basis".

Accessibility of drinking water and user's satisfaction our results are with agreement to the studies of Larson, Minton and Raza Findralambo (2006) and Briand et al (2009) that consumers satisfaction level is very much effected by accessibility of drinking water he use. As expected households using "in house up to 1/4km" drinking water source such as tap into house, protected well and protected tube well in house are more satisfied than households having access to "1/4km up to 1km" and "1km up to 3km" water sources such as unprotected well, rivers, lakes etc. The satisfaction level shows that if there is one unit change in their water availability distance, the relative risk of not satisfied to satisfy is decreased by factors 0.655 and 0.489 respectively, given all other variables to being held constant.

Income of the household head is the most important socio-economic determinant of consumer satisfaction. Unfortunately, we don't have income data, so we used roof structure, number of room's latrine type and occupation of household head **as proxy for income**. All these factors combine by principle component index form income index. It is expected that there exist a positive relationship between income of household head and satisfaction that is, low income group tends to be not satisfied

with drinking water as compared to high income group, who uses improved water for drinking and will use tap into house or protected well or tube well in house.The odd for very poor is 1.778 in above (mentioned table). It means very poor people are likely to be not satisfied as compare to non-poor people who are satisfied. The odd of poor income group in favour of not satisfied is 1.528 times over satisfied compared to the non-poor income group.

The results for four provinces namely Punjab, Sindh, KP and Baluchistan shows that odd ratio of Punjab, Sindh in favour of not satisfied is 0.922 and 0.338 times respectively as compared to Baluchistan with satisfied consumer which show has negative impact on not satisfied as compared to satisfied if there is one unit change in province preferences. This shows that in comparison of Baluchistan, in Punjab and Sindh has more satisfied consumer with water. However the odd ratio of KP in favour of not satisfied is 1.021 times greater as compared to Baluchistan with satisfied consumer which shows that if there is one unit change in preferences of water satisfaction relative to not satisfaction would be expected to increase in not satisfaction, given other variables in the model remaining constant. This shows that there are more consumers unsatisfied with water in KP as compare to Baluchistan.

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Chapter 5

Conclusions and Suggestions

5.1 Conclusion

In our study we used use three found socio economic determinants of three different variables namely Sources of drinking water, Accessibility of drinking water and consumer satisfaction with drinking water. We will conclude the result individually.

1. The regression analysis of sources of drinking water finds that demographic characteristics (such as family size, no. of rooms, gender, occupation, roof structure, type of latrine) socio-economic factors (such as facility of gas) and geographical factors (such as rural urban and province) have pivotal role in determining household source of drinking water.
2. Results for accessibility of drinking water indicates that factors which are significant in determining household accessibility to drinking water includes demographic factors (such as no. of rooms, family size, education and occupation of the household head, roof , latrine), socio-economic factors facility of gas and electricity) and geographical factors (such as Rural urban and provincial division).
3. Talking about user satisfaction with drinking water they use. The characteristics which determines the satisfaction are age, facility of electricity, source of drinking water, accessibility of drinking water, income of household head and provincial division.

5.2 Policy Implication

Based on our findings, it is recommended to others; who are interested to do study on the topic that given the source and availability of drinking water as shown from the findings of the study, the government should endeavor to bring safe drinking water facilities closer to the people especially in the rural areas. This can be done through the establishment of new govt. sector drinking water facilities. Also, government should improve on its provision the quality of drinking water .Given the perception of people about the tap into dwelling quality of drinking water especially in urban areas, which many believed is poor; there is the need for the government to improve the quality of drinking water. The results indicate that as quality increases the satisfaction of consumers will increase significantly. Policy makers need to keep this in mind when developing strategies and polices aimed at increasing access to safe drinking water. This study provides basic understanding of main determinants of sources and accessibility of drinking water, but further in-depth studies are recommended to determine how the govt. drinking water provider will finance expansion and the effect of this on consumers' satisfaction. We call for policy and legislative changes and drinking water-system interventions to provide safe drinking water accessible to all over Pakistan. Last but not the least; awareness campaign about dangers of drinking unsafe water more specifically for the rural areas should be started by the government via different social media networks.

5.3 Recommendation for Future Study

This study provides basic understanding of main determinants of sources of drinking water and availability of drinking water used by households and satisfaction with drinking water they use .Due to a lot of limitations of the data but further in depth

studies are recommended to determine how the govt. drinking water provider will finance development and the effect of this on getting safe drinking water and its availability to all households across Pakistan. We have to take up proactive approach in order to introduce proper SOPs (Standard Operating Procedures), improvement question to the technologies of the day and profound legislation in the existing drinking water system. So the remedial steps may be taken at its optimum level to target the non- communicable as well as communicable discussions in Pakistan.

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Appendix

Questionnaire Used in the Study

Q1. Age of household head?

---------- (*write answer in years*)

. 98. Donot Know 99. No Answer

Q2. Gender of household head?

1. Male 2. Female

98. Donot Know 99. No Answer

Q3. Education of Household Head?

1. Uneducated 2. Under Matric 3. Matric

4. Intermediate 5. Graduate and Above 6. Others

98.Donot Know 99. No Answer

Q4. No. of Family members?

---------- (*write number*)

. Donot Know 99. No Answer

Q5. No. of female adults in family?

98.Donot Know 99. No Answer

Q 6. Occupation of household head?

1. Unemployed 2. Unskilled Labor 3. Skilled Labor

4. Clerk/Office Worker 5.Professional 6. Agriculture

7. Self-Business 8. Other

98.Donot Know 99. No Answer

Q7. Roof structure of the house?

1. Linter 2. T-Iron 3. Mud

4. Wooden

98. Donot Know 99. No Answer

Q8. What is the type of latrine you use?

1. In house 2. Outside the house

98. Donot Know 99. No Answer

Q9. Do you have facility of Electricity in your house?

1. Yes 2. No

. Donot Know 99. No Answer

Q11.Do you have facility of Gas in your house?

1. Yes 2. No

. Donot Know 99. No Answer

Q12. From which source you use water for drinking?

1. Tap in house 2. Wall in house

2. 3. Tube well in house 4. Hand pump in house

5. Wall in street (open wall) 6. Hand pump near house

7. Tube well outside the house 8. River

9. Spring 10. Lake

11. Bottle water

98. Donot Know 99. No Answer

Q13. How far is that drinking water source from your house?

1. Inside the House 2. ¼ km from house

3. 1km up to 3km from house 4. More than 3km from house

98. Donot Know 99. No Answer

Q14. Are you satisfied from your drinking water source?

1. Satisfied 2. Not Satisfied

3. Nor satisfied neither unsatisfied

98. Donot Know 99. No Answer