Estimating Willingness to Pay for Drinking Water Quality in Nowshera Pakistan: A Domestic Study for Public Health

Shazia Parveen*   Jahangir Ahmad   Masood U Rahman
Department of Applied Economics, Institute of Management Sciences
1-A, Sector E-5, Phase VII, Hayatabad, Peshawar, Pakistan

Abstract
This study discloses the behavior of household's willingness to pay for improved water quality in Nowshera city. Simple regression model is used to reveal the preferences of household's towards safe water. Study empirically concluded that awareness and income has significant impacts on household decision making for better water quality in order to reduce the health risk and vulnerability towards water born diseases such as typhoid, dysentery, cholera and diarrhea. Formal and informal education also has crucial effect on demand for purified water. Study further shows that those who have more income and high level of qualification are more willing to pay for clean and safe drinking water. Background of this research have concern towards low water quality, which causes the health hazards to human life which may increase their health cost and effect the decision of HH regarding willingness to pay. Primary data was collected from 200 households of Nowshera. Results showed that income is the one of main factor which has major effects on demand of enhanced water quality. More people were willing to pay to the government in order to get safe water while very less amount of HH were in favor of private pr respectable organizations. Filter cost also indicated some relationship with WTP, those who have more filter cost was able to pay more because their cost was more than the filtration cost. Health expenditure exposed the positive relationship with demand for purified water, high health expenditure bearing HH were more able to pay to reduce their cost. Awareness and income were the key factor for estimating the willingness to pay for improved quality of water to get good and healthier life.

INTRODUCTION

Traditionally water was used as a free commodity because at that time water supply was in surplus but now in recent times water became a scarce good because swift increase in population growth which is being cause to polluted water sources. More than half of the population is deprive from improved water and they are more vulnerable to water born diseases.

Water is non marketed good environmental good which was available in excess but now a day's water known as scares good but rapid increase in birth rate or population is the main responsible component to make it insufficient resources, but this insufficient accessibility is also the problem because human being has depleted this resource in very worse manners. So it has to be making clean, safe and to increase its quality. Clean drinking water is the basic need for human life it's not only raised the standard of living but improves the health of individual but also reduces the health cost by controlling water associated sickness.

Estimates showed that more than one million of people out of 6 millions don't have excess to safe drinking water. With passage of time per capita water accessibility has been declining not only in Pakistan but around the globe it's going down. During 1951 in Pakistan, per capita water availability was 5,000 cubic meters but then in 2005 it has been decreased to 1,100 cubic meter [WWF Pakistan (2007)]. Provision of safe drinking water is one of the fundamental rights of human being which leads to achievement of effective health.

Drinking water low quality is the cause of water born diseases like cholera, dysentery, diarrhea, typhoid and hepatitis A which not only generates the higher health cost but low level of productivity so we can safe excess to clean drinking water is very crucial factor for human healthier life.

World Health Organization revealed the estimates of 2004, showed that every year 1.8 million people die due to diarrhea and cholera. Unsafe water supply, insufficient sanitation and poor hygiene are the cause of 88 percent of diarrheal cases. 200,000 children die each year because of diarrheal disease, in Pakistan 30 percent of rural people have safe drinking water facility while rural people ratio is just 23.5 percent.25 percent of diarrheal cases can be shrink if we attain better water quality. The causes of less percentage are that government does not have adequate resource to solve this issue. Willingness to pay leads to benefits so government has to do cost benefit amylases [Rosemann (2005)].

So it's necessary to find out the willingness to pay of the household regarding safe drinking water because it reduces many risk related to human life and show the demand for clean drinking water. In developing countries less number of people is willing to pay for better water quality because they have low level of income and they don't have awareness about water born diseases and damages to health or health cost. There is a need to protect water from being polluted because it is very essential for the survival of life on earth.

In general Low water quality is an alarming situation nit only for household but also for those institutions that supplies water to households, so water quality should be enhance on critical basis. This can be achieved

through efficient water administration strategies such a examining and supervising the water delivery which is provided to households. There is need to work for the sustainability of water quality which shrink the risk of water related infections.

There is a frequency of occurrence of water born diseases in Nowshera due to mismanagement, overpopulation and low level of water quality. Objective of the study is to analyze whether people are aware from the low water quality and which can cause the serious threats to human life, if households concerns to water quality so these harmful effects can be lessen. Further it will elaborate the demand of house hold for the attainment of high quality of water in district Nowshera. To find out the WTP of HH they used simple OLS method through which we obtained desired results.

Objective of the study

The objectives of research are:

- To find out the household WTP for safe drinking water.
- Effect of water polluted water on health.
- How education affects the demand of clean drinking water.
- To reveal the consumer's preferences towards better water quality.

Research question

What is the willingness to pay of household for safe drinking water quality?

Hypothesis

H0= there is positive relation between income and willingness to pay
H1 = there is negative relationship between income and willingness to pay.

Scheme of the study

In this study the first chapter contained on introduction, second chapter is literature review, third consist of methodology and forth chapter incorporated the analysis of the data. The fifth chapter is including result, discussion and conclusion.

Significance of the study

Relevant literature exposes the willingness to pay of household for improved quality of water. It will further investigate the different effects of variables which are responsible for safe water supply. It will reveal that how education is related to water quality and how income will affect the demand of clean water

LITERATURE REVIEW

We have huge collection of literature which exist to find out the value of non marketed goods and plenty of literature available to analyze the willingness to pay of the household for getting clean and safe drinking water because water is very essential component for the survival of not only human being but for other species also.

Related to human being low water quality leads individuals towards water born disease like cholera, typhoid, viral infection, dysentery, diarrhea and we can say hepatitis A, so to get rid from these diseases we have to use safe drinking water which would help household to decrease their health cost. Through safe drinking water HH can increases health status.

The quality of water whether we use for drinking, food production household or recreational purposes has important effects on human life. Poor water quality can contribute to the generation of waterborne diseases. Management for the safety of water do not only improves public life but often support socioeconomic development and well-being as well. (WHO water quality and health strategy 2013-2020).

Study conducted in Vietnam to reveal the WTP for safe drinking water by the citizens of Vietnam. In order to get significant result 235 household size was taken. Two traditional methods (CVM and ABM) were used along with the binary logit regression. Geographical attribute, culture, earnings, education were the most important determinates which affected the general public perception.

Outcome of the study showed that people are more willing for safe drinking water. Standard of living, income, education, customs were also the part of variables. Policy recommended that government should take serious actions to provide qualitative water particularly for those who have small income and they are restricted to pay more for quality of water. (kuch, (2013)

So-Yoon Kwak et al (2013) have done their work for estimating the tap water quality in Pusan which is the second biggest city in Korea. Odor during using tap water, income, gender, age, education was their variables for estimating willingness to pay. Researcher used CVM method and spike model. The purpose of the study was to increase tap water quality in Pusan Korea. 2.2 (USD) was monthly willingness to pay per household. Pusan water source was local government and they are provided water on lower price in comparison to production cost. For conducting the study through CVM highly educated population gave more help to estimate the results. (Kwak, p. 2013)

Study revealed the general idea of experimental facts related to the WTP foe safe water quality I less developed countries. According to author a major push has been exposed in previous years towards not only to get access to clean drinking water in order to promote water quality but also technological treatment such as

chlorination and filtration. Author examined that cost of those technological treatments was more than the willingness to pay of the household. (Null, 2012)

They have done study in the area of Peshawar, Hayatabad sited in north Pakistan. This article contained on 150 household which were randomly select for the conducting the survey. To elicit the WTP as well as risk averting behavior, for clean dirking water author used a CVM along with the multinomial econometric model.

The indicators such as income, education and exposure to media indicated that people of this town are willing to pay for the better water quality. The article revealed that bill charged by City Development and Municipal Departments are less and people willingness to pay is more in that area in order to get safe drinking water. (Himayatullah, 2010)

The CVM method used to examine the value of water as non economic good, to estimate demand for clean and safe drinking water in district Peshawar. They used multinomial logit model. Results were obtained through primary data with 315 HH size. HH income, size, awareness and education were the significant parameters. Study empirically concluded that along with income awareness is also the important factor for estimating the demand of improved water quality. (Iftikhar, 2010)

Dr. Himayatullah (2010) calculated the demand for improved drinking water though income and price elasticity in Peshawar Pakistan. Calculation revealed that safe water is necessity good for the citizen of Peshawar. The study showed direct relationship between income and WTP. Estimates exposed that clean drinking water increased welfare of the small income groups than the higher earning groups.

This study is conducted in a modern area of Peshawar named hayatabad; it contained on seven phases but to some constrained researcher selected six and seven in order to conduct a research. Questioners were developed for revealing the preferences of households about the usage of bottled water while for WTP and awareness CVM used by the researcher. The significant factors found by the examiner, were WTP and income of the household which affected results. S there is a need to provide safe drinking water not only in one region but in whole Pakistan in order to get healthy and qualitative life.

Contingent valuation survey technique was practiced to find out the WTP for clean drinking water by Vasquez (2009) in Mexico. Private expenditure alternative and risk averting behavior was implemented by the household such as use of purified bottled water, purification of water through various methods and water storage facilities plants were installed in order to access reliable water for drinking purpose. Study concluded that people of Mexico were able to pay more money than their water bill for the sake of safe drinking water.

Worldwide people are dying every year from poor water quality; estimates showed the 26% of death happened due to infectious diseases caused by photogenic bacteria. (WHO, 2002; UNEP GEMS/ water program 2008)

A study by Akter (2008) anticipated safe drinking water economic value in rural area of Bangladesh. Num of children in house, age, education, media exposure and water source were the important factors which concluded the results in very useful way.

In South Africa due to poor water quality and bad sanitation more the 0.5 million deaths of infant happened every year. Poor water quality leads to different water born disease like diarrhea, cholera and other water born disease which leaves bad impact of economy

We have abundance of literature to estimate the value of non market good. Within the series of different techniques we have the contingent valuation technique is commonly used technique to estimate the willingness to pay for any kind of non marketed goods.

To examine the WTP for improving water service in district Abbottabad, Miraj.ul.haq used the contingent valuation method. According to their results, HH location (urban or rural), family member's education and water supply were the parameters used to analyze the WTP for drinking water quality.

Sattar and Ahmad (2007) conducted the same analysis for district Hyderabad; by using multinomial logit model they used averting behavior approach for their study. Their findings showed that education of household and their awareness to media, considerably affects the WTP for better water quality.

Usman Mustafa et al (2007) used the common technique called CVM for improving the water quality in Abbottabad district. Education, earning, demographic characteristics and source of water were the variables for estimating the WTP.

In order to get the results they used econometric model named logit model, through this they found out the variables relationship. Results revealed that in Abbottabad water quality is not reliable, people are more willing for the improved water quality. Awareness has the considerable importance in order to influence the perception of community toward the enhanced water quality.

Purpose of the study was to analyze the WTP of the individuals of Indonesia to get clean and safe drinking water. Hedonic pricing technique was used to find out the WTP of the Indonesia's citizens. Results were obtained by using logistic model, age, family member's size; education expenditure per capita affected the availability of water. Study showed the education of individuals had more impact on the results.

Study suggested that government intervention is needed to expand on improving the water quality which

is responded by household after analyzing the willingness to pay of household. In rural area willingness to pay is less so there is a need of government incentive in from of subsidy. Education is taken as a very essential factor which helps to increase the knowledge of individuals as well as to promote awareness. (Bilang et al, Nov 2007)

Regarding safe drinking water most of the researchers have conducted studies on WTP and averting behavior in developed as well as developing countries. Various estimation techniques are being used such as CVM, which is commonly used method for examining the willingness to pay of household.

To discover the effects of drinking water supply hedonic price model was being used to estimate the factors which affect the accessibility of water. Human capital, water sources and earning were those variables which created a path to get significant results and logistic econometric model was used to analyze the results in order to hit the conclusion. (Hartono and Harahap, 2007)

Chowdhuri and Somanthan (2003) have done their study in urban India to find out that the demand for cleaner environment could be increase by raising the awareness associated with unfavorable health consequences of environmental pollution. According to their study decision related to home water purification is being affected by wealth and awareness.

To analyze the willingness to pay for improvement of drinking water quality they used the various home purification techniques and their respected average cost. They examined that awareness through media and schooling had empirically considerable effects on home purification methods.

Every individual has the fundamental right to get safe drinking water, world's population is tripled in previous 100 years, but water usage is increased by six folds. (Frank et al 2000)

Water is most crucial factor for existence and maintenance of life on earth. It's the basic right and need of every individual in order to get healthier life. 97% of ocean water is not appropriate for drinking, we have 3% of fresh water in which 2.97% is glacier water and for human use only 0.3% water is available (miller, 1997).

All the literature showed that mostly researchers used contingent valuation approach for analyzing the willingness to pay and logit model used go get significant results. So I will use the CVM and logit model to reveals the willingness to pay of households.

METHODOLOGY

Budget allocation is the main issue of household decision about daily life in every economic theory and literature available. In this part of the study theoretical consideration of human preference is being explained and to estimate the demand for safe drinking water methodology is used in which demand or WTP is the function of education, awareness and consumer's income. Moreover health expenditure, water filtration cost and size of the household also have effect on the demand of clean water. [Deaton (1980)]

Theoretical frame work:

According to Deaton and Muellbaure (1980) traditional demand theory reflects that demand function affects through certain factors like income of the individual, preferences, taste, cross price, own price, demographics, education level, awareness and we can say household's profession. Through multi stage budget procedure household can do decision making about budget allocation in an effective manners.

Household gives more preferences to necessities so first he/she will spend income upon food, health etc while consumption of safe drinking water and many other item will come in second stage in order to allocate budget or income.

To treat water born disease like diarrhea, cholera, typhoid etc consumer spends their income. According to the Engel observation, household faces skewed shape curves of income and consumption which means the if individuals has more income so they are willing more to spend their income level in order to get purified water because high income level people prefers luxuries goods and less necessary good.

According to Iftikhar (2010) willingness to pay to safe and clean drinking water depends upon many factors like income, education, awareness and household size etc. result showed that higher level of income give more preference towards safe water quality if households are earning more income so they will be willing more in order to get purified water to decrease their health cost or prevent their self from water born diseases like typhoid, cholera dysentery etc.

if we talk about education so it will not be wrong to say that education is a very crucial factor though this individual is able to aware his/her own self it affects WTP positively. Awareness is also a very essential factor it can be through print media or electronic media. People who get more aware from water born diseases and health cost will be willing more to pay for the safe water or we can say environmental good so it has positive impact of WTP.

Household size has also positive impact upon WTP if numbers of people are more in house and they have education and awareness so they will prefer more for clean water to prevent their self from health cost. Health expenditure has negative impact on WTP because, if we have less health cost so they will be more budget allocated to get safe water. So in our model WTP depends upon income of the household, education, filter cost, awareness, household size and health expenditure.
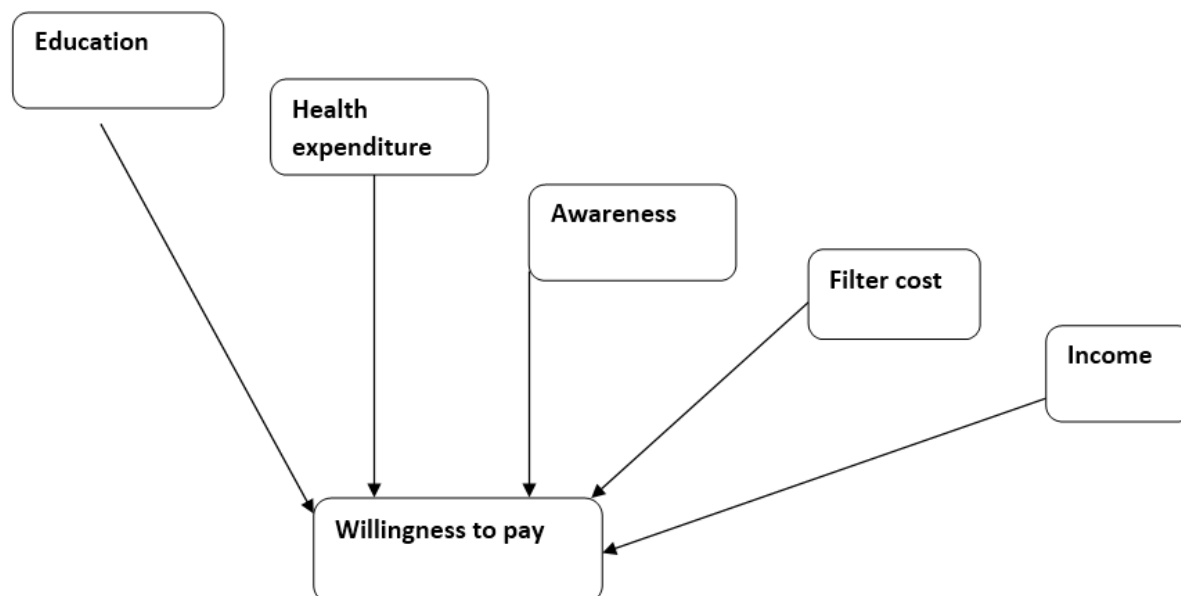
To get significant estimates for improvement of water quality mainly we used stated preferences approach in which we go directly to household and ask them willingness payment to improved water quality, this method is known as contingent valuation method (CVM).

Contingent valuation method (CVM)

To estimate the willingness to pay for improvement of service or environmental good we apply technique called CVM. This method basically uses by researcher in order to determine the value of non environmental goods. It contains questioners or surveys which reveals the individual's choices for such type of goods. [Carson et al (1993)]

There are two direct and indirect techniques used by analyst in order to examine the willingness to pay for safe water quality. One is CVM which is commonly used by researchers to analyze the WTP. [Abdullah et al (1992)]

For an extensive range of environmental issue (such as water sanitation and supply) this technique has been adopted successfully. In recent times both for developed and under developed countries this technique is productively approved for numerous of environmental related goods.

Data collection

Primary data collected while conducting this research.

Sample size

Study has 200 sample sizes in order to obtained results.

Econometric specifications

There are some variable which might affect the model or may be the cause to associate these variables like purifications measures by the HH in their own homes. These variables completely affect a variety of characteristics of HH, so there is a need to construct an econometric model which split out the effect of every variable.

To observe different variables for WTP, multivariate regression analysis was carried out which is given:

$$WTP_i = \beta_0 + \beta_1 (Edu) + \beta_2 (Aw) + \beta_3 (FC) + \beta_4 (HE) + \beta_5 (I) + \mu_i$$

Where:

WTP= willingness to pay of household for improved services (percentage of income)

Edu = education level

Aw= awareness

FC= filter cost

HE= health expenditure

I= income level

WTP is our dependent variable while Edu ,FC, A, HE and I these all are our independent variable which will affect out dependent variable WTP.

ANALYSIS

We will analyze the effect of independent variables which are income education, awareness, filter cost and health cost (which generated due to low water quality) on the demand for improved water quality that how much people are willing to pay for better water quality. For this purpose we used simple OLS method because we have taken willingness to pay in term of rupees.

Model 2: OLS, using observations 1-198
Dependent variable: WTP
Heteroskedasticity-robust standard errors, variant HC1

	Coefficient	Std. Error	t-ratio	p-value	
Const	-453.743	1169.49	-0.3880	0.02846	
HC	-0.208516	0.118277	-1.7629	0.07950	*
Aw	2517.46	589.458	-4.2708	0.00003	***
FC	0.761279	0.45	-1.6917	0.09232	*
Edu	622.666	298.337	2.0871	0.03820	**
I	0.0879189	0.0162499	5.4104	<0.00001	***

Mean dependent var	4103.131	**S.D. dependent var**	17987.72
Sum squared resid	1.12e+10	**S.E. of regression**	7643.606
R-squared	0.824014	**Adjusted R-squared**	0.819431
F(5, 192)	15.00276	**P-value(F)**	1.99e-12
Log-likelihood	-2048.345	**Akaike criterion**	4108.690
Schwarz criterion	4128.420	**Hannan-Quinn**	4116.676

INTERPRETATION

We have above results which shows the effects of different independent variables which are being regressed on dependent variable. They have constant which shows that 453.74 average effect of dependent variable when the effect of independent one is zero. If we pay attention to health cost its significant, it concludes that it has an impact of demand for better water quality if household bear more health cost so they will be more willing to pay for in order to get clean water which will decrease their health cost and reduces the risk of water born diseases like cholera, diarrhea typhoid, dysentery and hepatitis A. while collecting data we have seen that mostly people were complaining about disease which they suffered more that was diarrhea, cholera and typhoid. More health cost generates the demand for clean drinking water and enhance their willingness to pay. Education has also very significant affect on requirement of safe drinking water because education leads to awareness about water born diseases and health hazards which affects human life.

They have seen that household of Nowshera having more awareness related to low water quality and its harmful effects of human life. Filter cost also showed considerable impacts on WTP that those who have filter were willing to pay more because their filter cost was more than their WTP so for reduction in cost they were ready to pay. Some household were not WTP when they asked for their willingness because they thought that that this amount would not really increase their life expectancy or would not decrease their risk towards water related diseases.

Questions were asked about their WTP for government and private organization so mostly response was in favor of private organizations. Other indicator was taken income which exposed major outcome regarding HH WTP, it disclosed that people who have more income has more ability to pay because they have very high level on income, and low income response was little.

CONCLUSION & RECOMMENDTION:

The rationale behind conducting was to estimate the household willingness to pay among households of Nowshera District. Simple OLS model was used to estimate the WTP of household regarding demand for purified water. The purpose behind used OLS was that we have taken value of WTP in term of rupees (percentage of income). Questions were asked from HH about the WTP for private organization and government but more people preferred respectable organization. This study calculated that education has significant effect on demand for purified water. Study also found the impact of informal education (such print media and television) on behavior towards water purification.

This work leads us to conclusion that education has more powerful effect related to WTP, if people are educated so they will be more aware from health risk which comes from water born sickness and also about the generation of health cost which creates burden on household decision regarding ability to pay. Study statistically demonstrated they key constraint after income is the awareness associated to demand for safe water quality.
Following policy recommendation are obtained from the study:
I.   By making awareness among the people about methods of clean drinking water government and respectable organization can make a valuable difference.
II.   Powerful for public health interventions related to safe water are education and awareness campaigns. To

inform people about the health hazards due to unsafe water print and electronic media can be used to play a vital role.

III.   Women education is very important because mostly water purification measures are carried by them.
IV.   Government should install filtration plantations for provision of purified water to citizen.

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Water quality and health strategy (2012-20)

Annexure A questionnaire
The study is for Bs. Economics thesis and concerned with the willingness to pay for improved water quality that result from household preferences towards safe drinking water. This research designed to estimates of willingness to pay of household from Nowshera.
The objectives of this study are as follows:
1-   How much are people willing to pay for safe drinking water?
2-   Does WTP vary with education, awareness and income?
NOTE: The information gathered from this survey will be only for academic purposes, answers are recorded anonymous and information will be kept confidential and not disclosed to any part.
Filed by: _____   Gender:_____
Age:_____ Area where you live: _____
What is your profession? _____
The effects of water pollution on health:

1. **Does water pollution in your city (physically) bother you?**

☐ Very o   ☐ Sometimes   ☐ Rarely   ☐ Never

2. **Are you concerned with the effects of water pollution on your health?**

☐ Very much   ☐ Somewhat   ☐ Not so much

   a. **Do you aware from water born disease?**

☐ Yes   ☐ **No**

3. To become familiar with your health status and the health status of your family, could you tell us if the following individuals have ever had or have:

	You	Spouse	Children	Father	Mother	Brothers/ Sisters
Cholera						
Hepatitis A						
Viral infection						
Typhoid fever						
Dysentery						
Diarrhea						

Family medical expense per month;

Expenses	Amount in Rs.
Medical consultation fees (Dr Fee)	
Medication expense	
Number of days wasted due to illness	
Traveling Expense	
Miscellaneous expenses	

4. Do you think you are in:

☐ Good health for your age   ☐ Average health for your age   ☐ Poor health for your age

5. Are you willing to pay to decrease in water pollution, which will extend your life expectancy?

☐ Yes   ☐ No

6. If yes, to whom you prefer

☐ Respectable organization   ☐ Government   ☐ Both

a. What is your willingness to pay in order to get clean drinking water? _____

b.

7. What is your water filtration cost?

_____

8. What percentage of your income, you are willing to pay for increase in your life expectancy?(per month)

☐ 0% ☐ 2% ☐ 4% ☐ 6%   ☐ 8% ☐ 10%

9. **Do you think by making the payment you can gain an increase in life expectancy?**

☐ **Yes** ☐ No

What is the most affordable length of time during which you will want to pay? (your whole life)

☐ 6 months   ☐ 1year

10. Do you think the payment you will make is going to be equivalent to gain in the life expectancy?

☐ Yes   ☐ No

11. Are you confident of the stated percentage of income you are willing to pay to will increase your life expectancy?

☐ Yes I am   ☐ No I am not

12. Do you think the amount you are willing to contribute is going to be a financial burden?

☐ Yes   ☐ No

Demographics:

13. How many people live in your household? Including you:

14. Number of children living in your household: _____

15. Earning hands in house; _____

1. Your education level: _____

16. House hold income per month. _____

Literature review matrix

author	date	purpose	variables	data	Out come
Mirajul Haq (et al)	2007	Study determined the WTP of HH for safe drinking water in district Abbottabad.	HH characteristics, demographics, service characteristics (well, tube)	Data collected through random sampling technique.	Study showed statistically relationship of variables and education has significant impacts on WTP.
Sattar and Etazaz	2007	This study conducted to reveal the WTP of HH for clean drinking water.	Cost of purification, methods of purification, income level, education were the independent variables along with dependent variable such s WTP.	Primary data collected to get desired results.	Significant affects of formal and informal education.
Iftikhar et al	2010	This work exposed that factor which determines the public demand for safe water.	Independent variables of the study are HH size, income, awareness (media exposure), demographics	Data collected from district Peshawar in 2008.	Beside income awareness is the key factor of HH decision regarding improved water demand.
Dr. Himayatullah (et al)	2010	They estimated WTP for improved drinking water quality in district Peshawar.	Awareness water treatment practices, income and informal education were being regressed on WTP.	Data sources is primary and collection done in Peshawar district	Study concluded that income, education and awareness has significant impact on HH decision making regarding clean water provision.