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EVALUATING CONSUMER'S WILLINGNESS TO PAY FOR IMPROVED POTABLE WATER QUALITY

Sana Akhtar[1], Sara Bhatti[1], Aleena Naveed[1*], Rimsha Abid[1]
[1]Department of Environmental Sciences, Kinnaird College for Women, Lahore.

Article Info

*Corresponding Author
Email: aleenanaveed26@gmail.com

Abstract

This study investigated the willingness to pay for improved water quality in three different income areas of Lahore which includes Gulberg town, Nishtar town and Data Gunj Baksh Town representing the high-income, moderate-income and low-income areas respectively. On average, 51% of the household were willing to improve their poor water quality. Therefore, the residents of Lahore consider water as an economic good and are willing to pay for this provision. Majority of the respondents 51% are willing to pay money in the range of less than 500 (<500) to around 500 rupees as an addition in their water bill. On the contrary 56.1% respondents are willing to accept compensation ranging from 500 to 1000 rupees in case of poor drinking water quality supply to their homes. Determinants of WTP and WTA like qualification, ownership of home, area and time span of living in that area' showed positive correlation with WTP and WTA, while "income" showed negative correlation with the WTA, which indicates that public is aware of their need for better tap water quality and elimination of water related health issues and they are WTP irrespective of their income. The longer the people were living in an area, the more they were willing to pay for provision whereas despite of income and timespan of living, the people with larger families were more willing to accept the reduction in water bills as the compensation for poor water quality. The WTP sequence obtained from the study is Nishter Town>Data Gunj Baksh Town>Gulberg Town. This survey can prove to be very effective for government in understanding the need for improved water quality to the people living in Data Gunj Baksh town, Gulberg town and Nishter town, as well as for initiating a water improvement project to facilitate the residents of these areas by supplying safe drinking water.

Keywords
Willingness to pay, Improved water quality, Contingent Valuation Method

1. Introduction

Humans need water as basic need of their life. Safe drinking water is an essential constituent of primary health care and have vital role in poverty alleviation. There is positive correlation between increased national income and the proportion of population with access to improved water supply (Abrahams *et al,* 2000). An increase of 0.3 percent asset in household access to safe drinking water generates one percent increase in GDP. Whereas, provision of safe drinking water supply is an effective health intervention diminishes the death rate caused by water-borne diseases by an average70 percent (Andrabi *et al,* 2006). Inadequate drinking water not only resulted in more sickness and deaths, but also augments health costs, lower worker productivity and school enrolment (Haq *et al, 2007)*.

While, being a response from people in order to avoid environmental and health hazards is their Willingness to pay (WTP). It's a human preference measure that should be taken when budget is allocated in different sectors and taking developmental decisions (Brouwer *et al,* 2015). However, the preferred satisfaction from the public proposed actions is determined with the help of an empirical test called CBA. In developing world, the demand and willingness of people to pay for better drinking water quality is diminutive. The 'low level equilibrium trap' is the leading challenge of the developing countries, knowing equity, efficiency and sustainability as three equilibrium goals which must be attain. Moreover, at demand side aspect it is a defined negligence in policymaking, but the academics stress upon the household partialities in order to defined quality of services at different levels (Akhtar *et al,* 2017).

Sanitation is a procedure used for safe and secure disposal of human excreta and communal waste to ensure public health safety. It is a basic human need and municipal authorities were legally bound to provide affordable sanitation services to the community without any discrimination. In developed countries, every household is required by law to dispose-off their sewage into the sewer line provided by the authorities concerned (Bartram *et al*, 2005). However, in developing countries, lack of information regarding household affordability and non-availability of assessment data about willingness to pay (WTP) by the marginalized people were not addressed at planning level (Muhammad.*et al,* 2018).

Globally, the provision of water and sanitation services were not up-to the optimum level as 2.6 billion individuals live without improved sanitation services implementation of centralized experts' formulated policies (Mara, 2003). In developing countries, policies were formulated, massive funds allocated, but still these policies do not deliver the desired results because of the socio- cultural values and economic considerations of the people (Nawab *et al,* 2009). Beside this, unplanned urbanization, indiscriminate discharge of untreated waste and lack of appropriate remedial action further ignite the daunting situation (Muhammad.*et al,* 2018).

About 1.8 billion people die through the globe due to diarrhea and cholera which occurs from poor quality drinking water, according to the estimation of WHO and because of this people rely more on bottled water and its price start increasing. The bottled water consumption increases 13% every year in Asia. While, Pakistan has 90% of the water supply coverage, where urban area has 95% coverage and rural area has 87% coverage of the water supply. But nowadays the overuse of water resource in different fields lead to the scarcity of clean water in Pakistan and raise many water pollution issues. This trend makes the Pakistan among 10 most water-stressed countries. The excessive disposal of untreated and hazardous waste from municipal, industrial and agricultural sector severely deteriorates the quality of surface and ground water reservoirs. The majorly populated cities of Pakistan like Karachi, Lahore, Faisalabad, Rawalpindi and Islamabad have more drinking water quality crises (Brouwer *et al*, 2015).

Various studies have been conducted to find out the WTP for better quality of water using contingent valuation method. A study conducted by (Kwak *et al*, 2013) focused on attaining the WTP values for improved water quality in Pusan, Korea. The mean WTP evaluation revealed to be significant. The monthly mean estimate for WTP by the respondents was 2.2 dollars per household. The mean value is equivalent to the 36.6% of the monthly water bill and 20.2% of the charges for water production. In order to provide necessary rights to the citizens as well as for the purpose of price stabilization, the local governments supply water at lower costs as compared to the production costs of water. The study used the contingent valuation method to find out the issue of tap water quality. The requirements for meeting the contingent valuation studies are based upon skills in sampling and interviewing techniques, as well as an educated population.

Another study reports the outcomes of a large contingent valuation survey for the evaluation of the WTP for improvements in the water quality of the Grand River watershed. The results indicated that the residents were willing to pay 4.50 dollars per household per a month, for improvements in the drinking water quality of the watershed. On the other hand, they were less willing to pay for the preservation of the environmental quality of the parkland in the watershed. Various socio-economic determinants of WTP were selected in the study. The main determinants proved to be income, number of children, satisfaction with the present water quality and awareness of the residents regarding the environmental problems. The study also revealed that the older respondents were willing to pay more for the preservation of the parkland of the watershed (Brox *et al*, 1996).

Similarly, another study was conducted to observe the WTP estimation, using the contingent valuation method for the drinking water improvement and the reliability of the water supply. The mean WTP value was obtained to be 16.71 yuan per household, which is equivalent to

0.3% of the total household income. The results of the study showed that the fewer members per households along with more education level as well as income are more willing to pay for better water quality, as a part of their monthly water bill. Another determinant for WTP was proved to be the respondent's views and concern regarding drinking water quality and the health risks associated with tap water, which could have significant positive effect on the respondent's willingness to pay (Jianjun *et al*, 2016).

The three locations of Lahore are considered into the paper in order to evaluate the improved water quality demand and to find that attentiveness of people about their drinking water quality and its adverse effects on them. Moreover, it also aims on the aspects that effect WTP for improvement in the quality of drinking water, the average education level, scheduled salary and health status of residents and the authoritative factor in that contributing willingness to pay with the help of contingent valuation. Therefore, the present study aims to assess.

- The willingness of the residents to pay for improving the quality of their drinking water facility in 3 different areas of Lahore, Pakistan i.e, Gulberg Town, Nishtar Town and Data Ganj Buksh Town located at 31°15′—31°45′ N and 74°01′—74°39′ E.

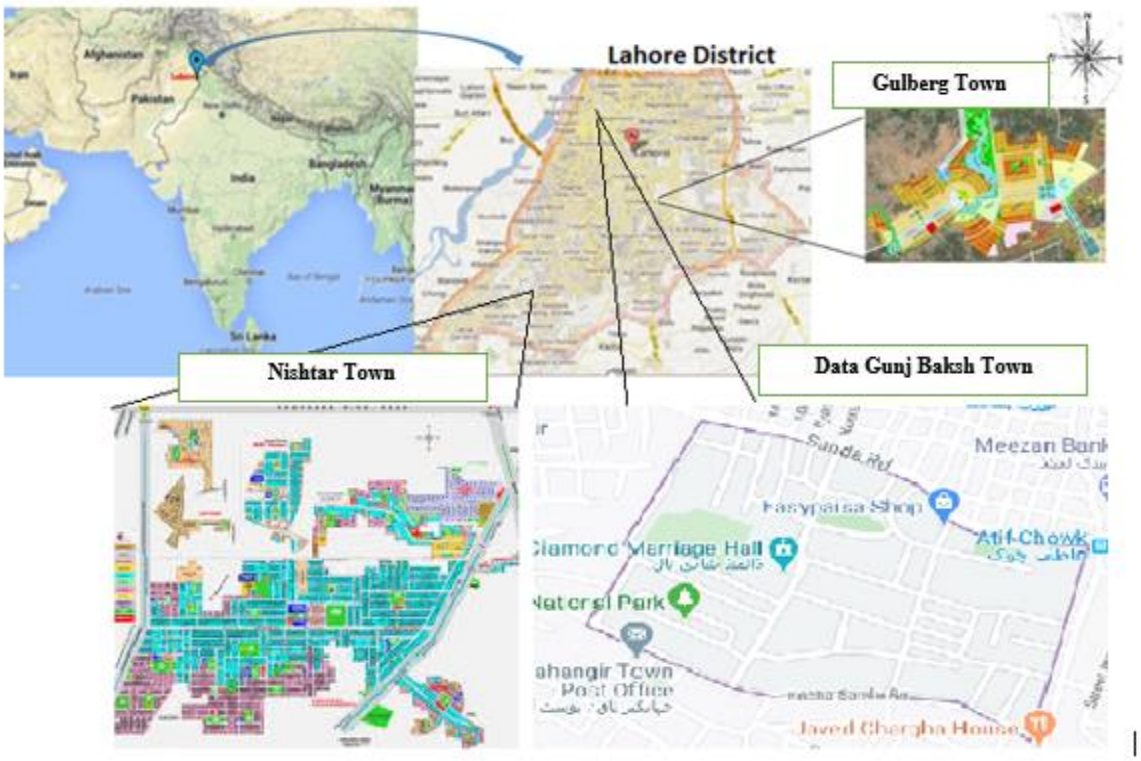


Figure 1: Map of Study Areas

2. Methodology

2.1.Collection of primary data

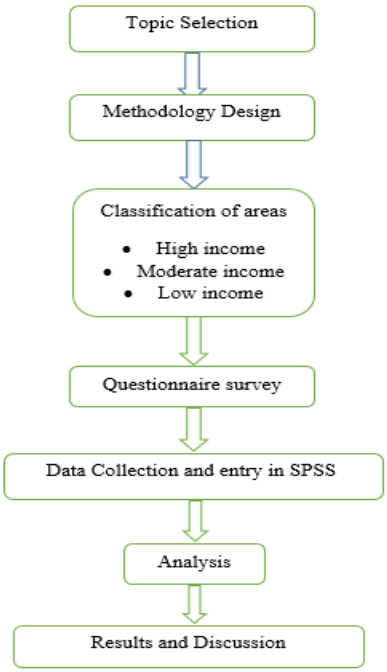
The purpose of this study was to check the willingness of people living in the selected areas, to pay for provision of clean drinking water through a questionnaire survey.

2.2.Questionnaire Survey

Total 303 respondents were surveyed in selected areas of Lahore through a questionnaire consisting of the demographic status of the respondents, the general information about the water source and its quality, their health status and WTP for improved water quality.

2.3.Statistical Analysis

Mean, median and mode will be applied using SPSS software version 20 on the data acquired through questionnaire. Relationships of monthly income, qualification, family members, area, timespan of living and ownership with WTP were developed.



3. Results and Discussion

This study was designed to determine the water quality and the public willingness to pay and unwillingness to pay/accept in Lahore. Lahore was categorized into three parts; high-income, moderate-income and low-income areas correspondence to Gulberg town, Nishtar town and Data Gunj Bakhsh town respectively, total 303 households were surveyed; hundred and one from each area. The sample of residents were chosen to establish the good representation of the water quality issues faced by them and their willingness to pay and unwillingness to pay/acceptive with respect to their education level, income and the number of members in their household.

The survey was divided into three sections, asked five contingent valuation questions provided in appendix. These included the questions related to WTP for improved water quality. In addition to contingent valuation questions, other questions related to their socio-economic status, political ideology; perception of water quality and sense of satisfaction; water source; preference for drinking water source; their concern for improvement of water quality; use of tap water for cooking purpose; problems experienced using tap water; water storage facility at household. Among all these, socio-economic factor is considered to be of great importance in terms of willingness to pay (Nabsiah *et al*, 2015). The current public perception on water quality is summarized in Table 1. The first two variables in table are responses to rate the overall water

quality on a scale of 1-5 ranging from very good to very bad and the sense of satisfaction in simply "yes", "no" or "not sure". The survey depicted water quality in selected area received slightly more than '3' or 'average' going towards 'bad' grade by survey respondents. The quality of water was further defined by the three parameters; smell, color and impurities, experienced by the respondents with mean value more or less '1' or 'yes' indicated the poor water quality experienced by majority of respondents. 49% of the respondents don't use tap water at all whereas 28 % rarely use it for drinking purpose and 37% always use it for cooking purpose, marked '2' on average for their concern about the water quality improvement which showed they have installed tap filters at homes and mean value '1' or 'yes, for the installed water storage tanks at home demonstrated the problem regarding the water shortage in selected areas.

Table 1: Household Perception of water quality

	Drinking water quality	Satisfaction with water quality	Respondents who drink tap water	Improvement measures for tap water quality	Using tap water for cooking	Private water tank installed at home	Experienced Smell	Unusual Color	Impurities
N	303	303	303	303	303	303	303	303	303
Mean	3.23	1.87	2.99	2.36	2.17	1.28	1.88	1.89	1.67
Median	3.00	2.00	3.00	2.00	2.00	1.00	2.00	2.00	1.00
Mode	3	2	3	1	1	1	1	2	1
Minimum	1	1	1	1	1	1	1	1	1
Maximum	5	3	4	4	4	2	3	3	3

Note:

- Drinking water quality (1=very bad, 5= very good)
- Satisfaction with water quality (1= yes, 2= no, 3= not sure)
- Respondents which drinks tap water (1=always, 2= always apart from minor exceptions, 3= never, 4= rarely)
- Measures taken to improve the tap water quality (1= boil water, 2= do not do anything to improve water quality, 3= use filter jugs, 4= use tap filter)
- Tap water for cooking purposes (1= always, 2= sometimes, 3= never, 4= rarely)
- Private water tank installed (1=yes, 2=no, 3= maybe)
- Experienced smell in tap water (1=yes, 2=no, 3=maybe)
- Experienced change in color of tap water (1=yes, 2=no, 3=maybe)
- Experienced impurities like particles in tap water (1=yes, 2=no, 3=maybe)

The survey also asked whether the respondents use public or private (bottled water) source for drinking water and 65% respondents marked private and 35% marked public which also demonstrated the lack of awareness regarding environmental issues and health risk associated with it which is the reason for some people less than average still use tap water for drinking and cooking purpose. The question regarding installed filtering devices at home received less than average 26% people don't use anything for the improvement of water quality confirmed the lack of awareness in some respondents.

In early experiments, researchers have used different methods of questioning with regard to contingent valuation questions. Those questions were usually open-ended i.e. how much the respondents were willing to pay for improved water quality. The CVM researchers criticized it for inaccurate responses. There are many alternative methods including a simple 'yes' or 'no' option for WTP, under which the respondents have given the amounts to set how much value they are willing to pay. This very method was employed in this current study.

The survey questionnaire was divided into three broad sections. The first section involved the personal information i.e. gender, qualification, income, number of people in a household, area of the respondent and for how long they have been living in the respective area. Second section was regarding the public perception about water quality and the third section was about the willingness to pay by given a scenario. Three questions were directly related to the problems related to water quality parameters faced by the respondent. These questions designated responses on (i) WTP to improve water quality (ii) WTP more on monthly bill to fund the water related project (iii) WTP extra amount for installation of water plant at respective area (iv) WTP extra taxes to government for taking additional actions for improving the water supply and (v) WTA compensation for the poor water quality, the willingness to accept (WTA) question was added to keep check on the consistency of the responses. In general, WTA is slightly greater than the corresponding WTP as consumers have real income in the former case.

In section three, the respondents were asked for their willingness to pay in context to the well specified scenario and cases. If they responded 'yes' then they were given an additional question below to mark the maximum amount they are willing to pay ranging from less than 500 to more than 1000 rupees or if they responded 'no' then they were asked to select any of the provided suitable reasons to ensure the validity of the answers. The mean, median, mode, maximum and minimum of the responses are shown in Table 2

Table 2: Overall Willingness to pay for improved drinking water quality

	WTP 1	WTP 2	WTP 3	WTP 4	WTP 5
N	303	303	303	303	303
Mean	1.67	1.81	1.76	1.71	1.59
Median	1.00	2.00	2.00	2.00	1.00
Mode	1	1	1	1	1
Minimum	1	1	1	1	1
Maximum	3	3	3	3	3

Note: WTP refers to the willingness to pay while WTA refers to the willingness to accept the compensation in case of supply of deteriorating water quality at the area of residence. These responses are conditional on the respondent giving a positive WTP or WTA.

On average, respondents were willing to pay additional Rs. 500 in their water bill for water quality improvement projects for correction of major contamination problem in respective sample area. Similar WTP was also reported in literature (Casey *et al*, 2006). The results of the scenarios are also presented in Table 2. Variable WTP 2 concerns the correction of overall poor water quality by funding through additional amount in water bill. WTP 3 asks the degree to which respondents might be the willingness to pay for the installation of water filtration plant in their area, WTP 4 refers to the WTP as a part of monthly water bill for additional actions (installation of new pipelines etc.) for improvement of water supply at area and WTA represents the willingness to accept the deteriorated water quality by respondents. The comparison of two means of WTP 1 and WTP 2 indicated that people are willing to pay more for correction of overall poor water quality rather than only for the correction of major water contamination which corresponds to the result of another study of Pakistan (Khan *et al*, 2010). The mean of WTP 3 is slightly more than WTP 1, showed on average people are concerned about their health and willing to pay for installation of water filtration plant in their area and the comparison of the means of WTP 2 and WTP 4 demonstrated that respondents are more concerned about the correction of present water supply system rather than taking additional actions for water quality improvement. These comparisons of variable mean clearly state the major respondents' concern regarding water quality improvement and their willingness to pay. The similar public perception is also reported in another study of Lahore (Akhtar *et al*, 2018). Fifth variable concerns the reversed situation, where water quality is allowed to deteriorate and reduction in water bills are assumed in a form of compensation. The comparison of mean value of WTA with the mean of WTP 2 showed that respondents were more likely to accept the compensation in the form of reduction in water bill as minimum as Rs. 500 whereas on average 32% respondents have already installed water filters at home while rest of the respondents lack health awareness and are not really concerned about their health risks.

a. Determinants of WTP Value

A comparison was conducted between the socio-demographic characteristics of the respondents and the willingness to pay to find out correlations among various variables studied in this paper. Characters like gender, qualification, household income, ownership of home, number of people living in the household, the area of residence (low/medium/high income) determines the willingness to pay for improved water quality at their area. The educated female respondents, household with children and high income tends to have more WTP (Genius *et al*, 2008). Table 3 shows the basic demographic characteristics of the respondents of the contingent valuation survey.

Table 3: General characteristics of sample households

	Gender	Qualification	Income	Ownership	Members	Area	Timespan	Job sector
N	303	303	303	303	303	303	303	303
Mean	1.61	3.73	2.89	1.28	6.41	2.00	2.22	1.65
Median	2.00	4.00	3.00	1.00	6.00	2.00	2.00	2.00
Mode	2	4	3	1	6	1	3	2
Min.	1	1	1	1	1	1	1	1
Max.	2	5	5	2	15	3	3	2

Note:

- Gender (1=male, 2=female)
- Qualification (1=no formal education, 2=primary education, 3=secondary education, 4= bachelor's degree or equivalent, 5=postgraduate degree)
- Income (1=less than 30,000, 2=between 30,000 to 50,000, 3= between 50,000 to 100,000,4= above 100,000, 5=above 200,000)
- Ownership (1=homeowner, 2=renter)
- Members refers to the number of people living in a household (short answer format question). The responses received showed minimum number of people to be 1 while maximum number of people was 15
- Area (1=Data Gunj Bakhsh Town, 2=Gulberg Town,3=Nishtar Town)
- Timespan (1=less than 5 years,2=between 5 and 10 years, 3=more than 10 years)
- Job sector (1=public, 2=private)

Table 4 shows the relationship between selected determinants for the willingness to pay (see appendix for questions WTP1, WTP2, WTP3, WTP4 and WTP5). Pearson correlation for each determinant was obtained and the correlation is considered to be significant at 0.01 and 0.05 level of significance. Gender showed a positive correlation with the willingness to pay questions WTP1, WTP2, WTP3 and WTP4 while showed a negative correlation with WTA5 question. Moreover, the more qualified respondents gave a positive response for the WTP for improved water quality as well as the WTA compensation in case of poor water quality supply. Income shows a negative correlation with WTP. On the other hand, income shows positive correlation with willingness to accept compensation WTA5. The study also revealed that respondents belonging to all income ranges showed a positive response for WTP, which indicates that public is aware of their need for better tap water quality and elimination of water related health issues. Even, the respondents (50%) earning <30,000 rupees are also willing to pay for improvements in their water quality (Moffat *et al*, 2011). Ownership determinant also shows a positive correlation with WTP and WTA, which shows that the home owners tend to pay for improved water quality as well as for the installation of filter plants at their area of residence which is also

significant as they would want to improve the water quality of the area where they own their current land for present as well as future benefits. Area showed a positive correlation with the WTP2 and WTP4, while showed a negative correlation with WTP1, WTP3 and WTA5. It was revealed that the residents of Nishter Town (61 out of 101 respondents) were more willing to pay as compared to Gulberg Town (45 per 101 respondents) and Data Gunj Bakhsh Town (48 per 101 respondents). The WTP sequence obtained from the study is Nishter Town>Data Gunj Baksh Town>Gulberg Town. Timespan of residence also showed a positive correlation with WTP1,2,3 and WTA5 except WTP4 for improvements in infrastructure (underground water pipes etc.) for water supply. This showed that the respondents who have been living in an area for a long period of time tend to pay more for the water quality improvement as compared to the individuals who are not living for a long time at the respective area.

Table 4: Significant determinants of the willingness to pay for water quality

Variables	WTP 1	WTP 2	WTP 3	WTP 4	WTA 5
Gender	+	+	+	+	-
Qualification	+	+	-	+	+
Income	-	-	-	-	+
Ownership	+	+	+	+	+
Area	-	+	-	+	+
Timespan of residence	+	+	+	-	+

4. Conclusion

The outcome of the contingent valuation survey indicated that majority of the respondents are willing to pay for improved water quality at their area. The results also indicated that around 65.1% respondents use private sources for drinking water like bottled water/mineral water from water supplier companies etc. which is consistent with their need for improved water quality from the government sector. Majority of the respondents 51% are willing to pay money in the range of less than 500 (<500) to around 500 rupees as an addition in their water bill. On the contrary 56.1% respondents are willing to accept compensation ranging from 500 to 1000 rupees in case of poor drinking water quality supply to their homes. Determinants of WTP and WTA like qualification, ownership of home, area and time span of living in that area' showed positive correlation with WTP and WTA, while only one determinant i.e, "income" showed negative correlation with the WTA, which indicates that public is aware of their need for better tap water quality and elimination of water related health issues and they are WTP irrespective of their income. The WTP sequence obtained from the

study is Nishter Town>Data Gunj Baksh Town>Gulberg Town. This survey can prove to be very effective for government in understanding the need for improved water quality to the people living in Data Gunj Baksh town, Gulberg town and Nishter town, as well as for initiating a water improvement project to facilitate the residents of these areas by supplying safe drinking water.

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