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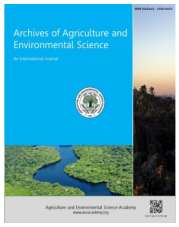

ORIGINAL RESEARCH ARTICLE

Willingness to pay for improved drinking water facility in Samsani Khui, Johar Town, Lahore, Pakistan

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ABSTRACT

Quality of drinking water is a universal problem specifically faced by many developing countries. Willingness to pay for improved drinking water facility of the people of a rural settlement, Samsani Khui, Johar Town in Lahore, Pakistan was assessed by questionnaire survey. This article intends to scrutinize the strong relation of these dynamics with willingness to pay by correlating them using chi square and multiple regression. Conferring to results, health status of the people of selected area revealed that 50% adults and 31.9 % children suffered from diarrhea within last 6 months. Education level of 48.6% people is middle school. Income of people lies between 5000-30,000 Rupees per month. People with poor health status held strong association with willingness to pay while low income level and low education level had weak association with willingness to pay. The highest and lowest value calculated are 53.969, -4.83, respectively and the mean ratio of willingness to pay was 1.835. The average willingness to pay calculated was between Rs. 1 to 5. This study depicted that various dynamics including health status, monthly income and education level of the people are the determinants of willingness to pay (WTP) for improved drinking water facility.

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INTRODUCTION

Willingness to pay (WTP) being a response from people, is used to avoid environmental and health hazards (Sattar *et al.,* 2007). WTP the measure of human preference should be taken in account while allocating budget to different sectors and taking developmental decisions (Pearce, 1998). CBA is known to be empirical test where the preference satisfaction is determined by the proposed public actions (Kontoleon *et al.,* 2002). Willing-to-pay and demand for good quality of drinking water is stumpy in developing countries (Sattar *et al.,* 2007; Pattanayak *et al.,* 2006). The foremost challenge that the developing countries have to face is 'the low level equilibrium trap', which attains three equilibrium goals equity, sustainability and efficiency. It is demarcated as negligence of demand–side aspects in policymaking, hence the researchers emphasize on the household preferences in relation to defined quality of services at different levels (Venkatachalam, 2006).

The developing countries are agonizing the greatest from this universal issue, i.e. polluted drinking water. As a result of this the people inside these countries are encountering numerous fatal and perilous issues (Casey *et al.,* 2006; Bogale and Urgessa, 2012; Null *et al.,* 2012). Water borne diseases, cancers, skin infections, diarrhea are some of the most common diseases grieved by people residing in the developing nations (Casey *et al.,* 2006; Orgill *et al.,* 2013). Several intrusions of international organizations are incessantly trying to improve the quality of water and the health risk associated with the ingestion of polluted and contaminated drinking water (Casey *et al.,* 2006; Genius *et al.,* 2008; Jalan *et al.,* 2009). WHO estimated that almost 1.8 billion people die out of diarrhea and cholera because of unsafe drinking water (Khan *et al.,* 2010; Brouwer *et al.,* 2015; Haq *et al.,* 2007; Moffat *et al.,* 2011).

The inclination of bottled water is increasing (water pricing) (de França Doria, 2010; Wang *et al.,* 2010; Doria, 2006). In Asia, the consumption of bottled water increased by 13% per year (Tayler, 2008). In Pakistan, overall coverage of water supply determined was 90% and urban and rural areas water coverage was 95% and 87%, respectively (Ali *et al.,* 2014). In Pakistan, the major source of protection and well-being of the people is provision of clean and pure drinking water. The scarcity of water and its extreme

use has distressed the quality of water immeasurably, making water pollution as the most perilous and significant issue nowadays. Pakistan comes in the list of those top ten countries, which are considered as the most water-stressed countries in the world (Brouwer *et al.,* 2015; Daudpota *et al.,* 2016).

In Pakistan, almost 6 percent of the water is supplied via hand pumps and pipes to the local people and these sources are the resting area of various pathogens, in which more than 30 percent are the vectors of different diseases and more than 40 percent are the death causing vectors. Surface water quality and ground water quality is deteriorating, due to the excessive disposal of untreated and hazardous waste from municipal, industrial and agricultural sector. The big cities of Pakistan such as Karachi, Lahore, Faisalabad, Rawalpindi and Islamabad are suffering from the problem of contaminated drinking water, as the population has out grown beyond limits (Naseer, 2013; Padawangi, 2010).

Many studies were conducted in nearby countries i.e. in Turkey, in a study conducted to evaluate factors affecting farmers WTP for water usage, the average WTP calculated was $170.6 and it was expected to increase with further good practices. Other factors affecting was age, education level, land area, ownership type, and modern irrigation (Aydogdu and Yenigun, 2016). A similar study in Turkey showed that farmers are willing to pay 71.69% more than the existing price (Aydogdu, 2016). In Nigeria, income demography and education level were the factors affecting WTP during household survey (Ifabiyi, 2011). According to the studies conducted in Pakistan, in the rural areas the household's WTP may depend upon the income, level of education and awareness. This exercise was a great effort in promoting local participation and ownership especially in women population, political and cultural reforms. It also depicted that more people are willing to pay to improvise drinking water quality which is carried out through a comparison of mid education level in male and female decision makers (Jalan *et al.,* 2009; Sima and Elimelech, 2013; Brouwer *et al.,* 2015).

The paper takes into consideration a mix of urban and rural setting area of Johar Town, Lahore, their demand for improved water quality and whether people are attentive regarding the quality of drinking water and its adverse effects. As per the previous studies, among the factors that influence WTP for improved drinking water quality, the average education level, monthly income and health status of residents are imperative factor in contributing willingness to pay (Sima and Elimelech, 2013; Brouwer *et al.,* 2015; Aydogdu, 2016; Aydogdu and Yenigun, 2016). Therefore, the present investigation was aimed to assess the willingness to pay for improved drinking water facility in Samsani Khui, Johar Town in Lahore, Pakistan.

MATERIALS AND METHODS

Study area: The study area was Samsani Khui, Johar Town in Lahore located at 31.4663° N, 74.2774° E. The survey was done in 2016. Random population of various age groups was taken for questionnaire survey. 210 respondents were surveyed with 95% confidence interval. The poor health and education conditions depict that the socio-economic standing of the area is extremely low, with income level range from 5000-30,000 thousand Rupees (50 -300 $) per month. The estimated population of the surveyed area is nearly 26000. Most of the residents are illiterate and the maximum education acquired by the children of the inhabitants is till 6th or 7th grade. 98% of the inhabitants are employed as servants in the residential colonies of Johar town, and few are masons, cobblers, electricians, plumbers and daily vendors.

Collection of primary data: The basic determination of the study was to assess the WTP and the perception of populaces regarding clean drinking water provision. The sole methodology pragmatic in the study was to check the willingness of the people living in Samsani Khui, to pay for the provision of clean and contaminant free drinking water. through a questionnaire survey.

Questionnaire survey: A total 210 respondents were surveyed in Samsani Khui through a questionnaire consisting of the demographic status of the people (age, gender, education level, monthly income and household type), information about the water source (type of water source, distance travelled from water source, current status of water which include hours of supply, reliability, water quality and satisfaction), the health status of people and their WTP for the improved drinking water facility.

Statistical analysis: Chi square and multiple regressions were applied using SPSS software version 20 on the data acquired through questionnaire. A relationship among monthly income and WTP was developed using Chi square. A multiple regression was also applied, where WTP is dependent upon three factors i.e. monthly income, education level and health status**.**

RESULTS AND DISCUSSION

Frequency distribution table shows, the frequency of each question or section people answered for the questionnaire (Table 1).

Demographic statistics: According to (Table 1) education level of most people is below average i.e. 48.6% people studied till middle school. Usually flats are present in that area and their monthly income is less than 20,000 Rupees (200$).

Information about water source: The current situation of water source in Samsani Khui, Johar Town states that 42.4% people depend on water pipes as there are more apartments but 51.9% people do not consume paid water source because collectively people rely on other than paid water source. The water condition of that area is getting inferior and the water is not all the time available in water pipes (Table 2).

Suffered from disease: Diarrhea is most common disease in adults and children of Samsani Khui. 50% adults and 31.9 % children suffered from diarrhea within last 6 months. Cholera was also common among children (Table 3).

Willingness to pay (WTP): 50.5% of people were not eager to pay Rs. 500 to 800 for improved water quality owing to many reasons as they don't have adequate money

Table 1. The frequency distribution of demographic of people in Samsani Khui, Lahore, Pakistan.

Variables	Frequency	Percentage
Gender		
Male	120	57.1
Female	90	42.9
	Education level	
No education	59	28.1
Middle school	102	48.6
Matriculation	43	20.5
Intermediate	6	2.9
	Type of households	
Mud houses	19	9.0
Flats	132	62.9
Katcha (Mud) houses	59	28.1
	Monthly income	
Below 5000	33	15.7
5000-15000	123	58.6
15000-30000	54	25.7

Table 2. The information about water source.

Variable	Frequency	Percentage
Source of water		
Hand pump	49	23.3
Tube well	57	27.1
Water pipes	89	42.4
Shared public tap in neighbor hood	14	6.7
Water tankers	1	0.5
Paid water source		
Yes	97	46.2
No	109	51.9
Amount paid for water		
None	33	15.7
Below 500 Rs	96	45.7
500-1000 Rs	81	38.6

Showing the frequency distribution type of water sources.

Table 3. Health status of households of Samsani Khui of different age groups within past 6 months.

Variables	Frequency	Percentage
Diseases in children		
Diarrhea	105	50.0
Skin Disease	50	23.8
Cholera	45	21.4
Malaria	49	23.3
Typhoid	41	19.5
Diseases in children		
Diarrhea	67	31.9
Skin Diseases	59	28.1
Cholera	80	38.1
Typhoid	89	42.4

Table 4. Variance in frequency of people willingness to pay (WTP) at Samsani Khui, Lahore, Pakistan.

Variables	Frequency	Percentage
Willing to pay Rs. 500 to 800 (5-8$)/month		
Yes	104	49.5
No	106	50.5
Percentage required people are willing to pay		
Nothing	77	36.7
Less than 5%	94	44.8
Between 5% to 15%	36	17.1
Don't know	3	1.4

Table 5. Chi square relation between WTP and monthly income.

Pearson Chi square	Degree of freedom (df)	Significance
15.468	6	0.017
Phi		Significance
0.271		0.017
Cramer's V		
0.192		0.017

Chi square, relationship of monthly income with WTP showing a significant relationship.

Table 6. Relation between three factors effecting willingness to pay.

	Mean square	F	Df	Significance
Regression	4.331	6.279	3	0.000
	R	R Square	Adjusted R Square	Std. Error of the estimate
	0.290	0.084	0.071	0.831

	Unstandardized Coefficients		Standardized Coefficients	T	Significance
	B	Std. Error	Beta		
Constant	1.058	0.277		3.815	0.000
Health status of households within 6 months	-0.082	0.063	-0.087	-1.303	0.01
Education level	0.245	0.074	0.221	3.300	0.001
Monthly Income	0.227	0.087	0.175	2.611	0.010

Multiple regression showing relationship of different factors (education level, health status and monthly income) with WTP.

Table 7. Ratio of willingness to pay at Samsani khui, Lahore, Pakistan.

	Willingness to pay (WTP)			
Health status (below average)	18.822	53.969	19.669	-1.654
Health status (average)	6.116	47.081	16.963	-4.83
Health status (good)	18.494	49.459	19.341	-1.982
Health status (excellent)	21.069	52.911	22.211	0.888
Education level (no education)	18.822	36.546	23.261	13.873
Education level (middle school)	29.357	47.081	33.796	24.408
Education level (matriculation)	14.902	32.626	19.341	9.953
Education level (intermediate)	5.837	23.561	10.276	0.888
Monthly income (below Rs. 5000 (50$)	18.822	26.651	14.574	8.379
Monthly income (Rs. 5000-15000 or 50-150$)	39.252	47.081	35.004	28.775
Monthly income (Rs.15000-30000 or 150-300$)	23.589	31.418	19.341	13.146
Monthly income (above Rs. 30000 0r 300$)	11.331	19.16	7.083	0.888
Mean			1.854715	

Ratio showing WTP of people of Samsani khui, different factors showed different variance.

and have uncertainties regarding the program (Table 4).

Factors effecting willingness to pay: Pearson Chi square in this study shows relation between monthly income and people's WTP. Chi square is a statistical method that assesses the goodness of fit between a set of observed values and those that are accepted theoretically.

Tables 5 show that the relation is statistically significant. There was significant association observed between monthly income and WTP (x^2 (6) =15.468, P=0.017).

Multiple regression showed the relation between health status, education level and monthly income with WTP.

Tables 6 show that WTP is dependent on monthly income, health status and education level. As P<0.01, the relationship is significant. Unstandardized coefficient depicts the extent to which dependent variable varies with the independent variables. In this study, the reduction in health status increases the WTP. Beta expresses the relative importance of each factor in standardized terms. As the monthly income and education level increases so does the people's WTP.

The general equation that predicted WTP from monthly income, education level and health status is

WTP is calculated in the Table 7**.** The above equation provides the range for WTP which is 1 to 54 rupees. Table 7 also gives range for WTP in people of Samsani Khui. Monthly income and education level have direct relation with WTP as with the increase in both of the factors the WTP also increases. However, health status has inverse relationship with WTP as with the increase in health status, the willingness to pay for improved drinking water facility decreases in people.

WTP rests on the three factors viz; education level, health status and income level. A modification in any one of these factors alters the WTP significantly. The table 7 also shows the ratio of WTP whilst possessing each of the factor constant and changing the other factors. The maximum and minimum ratio evaluated was -1.326 to 4.175 (Table 7). The average WTP calculated is between Rs.1 to 54 that people of the area are willing to pay for their improved health status as their average income doesn't allow them to

$$\textit{Willingness to pay} = 1.058 - (0.082 \times \textit{health status}) + (0.245 \times \textit{education level}) + (0.227 \times \textit{monthly income})$$

pay beyond this. The average WTP is calculated from above equation 1.

The establishment of safe tap water is more like a dream for every citizen of the developing country and many other poor countries of the world. 783 million people do not have access to clean water and almost 2.5 billion do not have access to adequate sanitation (Tarfasa and Brouwer, 2013). Many studies in India (Venkatachalam, 2006), Brazil (Casey *et al.,* 2006), Sri Lanka (Pattanayak *et al.,* 2006), Maun (Moffat *et al.,* 2015) are affirming the similar fact that WTP depends upon the demographic status of the people. Poverty and income level plays a major role in WTP. This study was conducted with the objective of estimating the WTP of the citizens of Samsani Khui, in order to improve the drinking water quality and to determine financial circumstances matter for this valuation. After the assessment and deduction it was derived that the natives of the village are very much willing to pay for the advancement of the drinking water quality within their limited financial resources. The condition of drinking water supplies in most of the developing countries is critically poor because of non-existence of financial resources. The above results depicted that health status have strong co relation with WTP. 53.969 ratio showed that the health status of people is below average and people with 5000-15000 rupees are willing to pay to improve their health. Whereas -4.83 shows very weak association with these groups for willingness to pay, as the people living in Samsani Khui, none of their monthly income was above 30,000 and being of excellent health status showed negative relation with WTP. The mean ratio was 1.835 (Table 7) which predicts how much of the people of Samsani Khui are willing to pay.The capital assumed for the recovery is much more than it is expected, because for reliable and sound services more capital is required (Subbaraman *et al.,* 2013).

WHO and UNICEF estimated that in 2004 almost 961 million people residing in the urban areas might get admittance to clean and pure drinking water, in order to attain the objective of consuming the people deficient access to clean drinking water by the year 2015. Contaminated water is related to adverse outcomes and it has a major impact on urban slum areas (Bhaduri *et al.,* 2016). It was noted the individuals with higher income levels were more willing to pay for the improvement of drinking water quality as compared to the individuals with lower income levels. 47.081 ratio shows that people studied till middle school, their average health status and with monthly income Rs.5000-15000 have strong correlation and this much people are willing to pay. The monthly income above Rs.30000 was zero so it had least correlation very less people were willing to pay as ratios 11.331, 19.16, 7.083, 0.888 shows weak linkages (Table 7).

The conviction of people on the governmental institutions is connected to the WTP, as this shows that the people see governmental institutions as effectual. And this strong bond amid the government and its people empowers the populace to give high cost for the betterment and improvement of water quality (Orgill *et al.,* 2013). Also the individual's competence of coping up with the social norms influences the WTP. Several efforts have been made to fill the spaces between clean drinking water provision and the people but the efforts are all in vain until the people don't cooperate with the government (Hering *et al.,* 2013). The water infrastructure of the urban areas has gradually evolved and improved since the past two centuries. But sadly, today we are facing one of the worst times and thousands of people do not have safe and proper access to clean and pure drinking water (Ahiablame *et al.,* 2012).

The fore most concern is that people already pay other taxes and the left income was merely sufficient for them to eat two meals a day. The additional problem was that people don't have assurance in the governmental institutions, as they collect taxes but no remarkable change is

pragmatic ever. The rapid growth rate of population in the urban areas is increasing the pressure on the governmental institutions that are responsible for providing people clean and safe drinking water (Wang *et al.,* 2013). But it is noted that people don't really involve in the policies regarding the conservation, improvement and management of the water supply. WTP also depends upon the beliefs of the people and their taste and preferences as stated in a study in Cambodian communities (Orgill *et al.,* 2013).

The people ought to involve themselves in the governmental policies and regulations for the betterment and improvement in drinking water quality. This is the fundamental right of every human being living in this world. Either the person is from the developing countries or the under developed countries or the poorest country, the right to the access of safe drinking water remains the same (Okurut *et al.,* 2015). The significant finding in the study was that the people with relatively higher amount of incomes are more concerned and positive about paying money for the water quality improvement of water. This is due to the fact that different social parameters are responsible in measuring their level of trust towards the government. The same finding was also reported in a study of Eastern Ethiopia for improved water conditions in rural areas (Bogale and Urgessa, 2012).

The government plays an essential role in refining the water quality, as they have all the capital resources which are required and obligatory for its enhancement. Standard of living and the level of income also greatly effects the willingness of people to pay for improvement of the water quality. Different studies have showed that 80% of all the diseases are associated to contaminated drinking water (Null *et al.,* 2012). Health status of people showed that people are willing to pay to improve their health conditions. The results of this study concluded that the people do know the consequences of drinking quality water but neither have they had much resources nor their financial condition allows them to afford mineral water for drinking. Hundreds of lives are lost due to water contamination, reported mainly in the developing countries. The level of progress is stagnant and never reaches its goal. The government takes initiatives for it but the capital allotted for it is never spent on it (Null *et al.*, 2012). One of the most interesting things revealed in this study was that the WTP was not affected by the drinking tap water frequency. But this is an issue which can be explored and investigated by the upcoming researchers, because the people who don't utilize tap water need to buy mineral water and this is costly as compared to tap water.

Conclusions

Improved water quality could turn out to be a stable living standard and is considered the first step for the area development. Various factors regarding people WTP for enhanced water sources in Samsani Khui was experimented. The elements that were perceived in affecting WTP are income level, education level and health status. The mean ratio of willingness to pay was calculated to be 1.835. The average willingness to pay calculated was between Rs. 1 to 54. Income level and education level were in direct relation whilst health status held inverse relationship with WTP. This demonstrated that as the health status of the people declines, more people will be willing to pay because they would be the victims. People of the area were willing to pay for improved water source. This is a positive indicator because this would enhance their living conditions and their health status. The government needs to take action in that area including the funding for future research in such projects as safe drinking water is necessity for life. The public of Samsani Khui is willing to invest in such project where they could gain safe drinking water.

Conflict of interest: The authors declare that there is no conflict of interest regarding the publication of this manuscript.

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