

IMPACT OF PUBLIC WATER SERVICE QUALITY ON HOUSEHOLD WILLINGNESS TO PAY IN ISLAMABAD

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ABSTRACT

This study estimates the household willingness to pay for enhanced services of drinking water from public filtration plants in Sector I-10, Islamabad. Using primary data collected from 362 households, we estimate the willingness to pay of the respondents for improved services of public filtration plants using the Contingent Valuation Method (CVM) and employ a binary logit regression model. The findings of this study suggest that 89% of the surveyed households are ready to pay for better services of filtration plants. "The evidence indicates a clear demand for reliable and safe drinking water services. The results also suggest that households' decision of paying for enhanced services of public filtration plants is a function of household income, education level of the household head, number of children in the household, and the household's knowledge about water quality and its related health risks. In addition, it is found that households are dissatisfied with overall water services due to poor management and safety concerns. Even households using bottled water also do not seem to be satisfied with overall water services, perhaps due to a lack of trust. For policy makers, these findings indicate that governance structure and the operation of public filtration plants should be enhanced. Ongoing maintenance and quality control are also required to ensure that these plants deliver more reliable services and to reduce health risks posed by the use of poor quality water.

Keywords: Willingness to Pay; Drinking Water; Filtration Plants; Contingent Valuation Method; Binary Logit Model; Urban Households; Pakistan

1. INTRODUCTION

Safe drinking water is a fundamental human need and an indispensable part of sustainable development. Water has been recognized as critical to alleviating poverty, enhancing public health and contributing to economic development. However, access to safe, reliable drinking water is a major challenge in the world even though it is important. Many people around the world still don't have safe drinking water, putting communities at risk for serious health issues and hindering their socioeconomic development. Water-borne diseases

like diarrhoea, cholera, dysentery and hepatitis, continue to cost households and healthcare systems, especially in developing countries, and unsafe drinking water contributes to these diseases (WHO & UNICEF, 2019).

Pakistan is one of the countries experiencing water stress as a result of rapid population growth, urbanization and lack of infrastructure. It was once believed that the country was water rich, but in the future it is expected that this will be one of the most water-stressed countries in the region (UN, 2017). Access to safe drinking water is limited in many

households in Pakistan, leaving many families with access to unsafe or untreated water. UNICEF (2019) estimates that only about 70 per cent of households in Pakistan have access to safe drinking water, which has adverse health impacts, especially on children. This results in thousands of children dying each year from water borne diseases like diarrhoea and typhoid caused by the lack of safe drinking water and poor sanitation conditions (UNICEF, 2015).

Urbanisation is an increasing problem, especially in large cities, due to the added pressure it places on the existing water supply system. The high concentration of population, industrial emissions and improper waste disposal have been responsible for the pollution of the water in urban areas. Polluted water not only harms the health of the people, but it also has significant economic impact, in terms of extra health spending and less productivity. The estimated annual loss in income and healthcare costs due to water and hygiene-related diseases in Pakistan is US\$380–883 million (Government of Pakistan, 2016).

To address these issues, public institutions have implemented a number of measures to enhance safe drinking water, such as establishing public drinking water filtration plants in urban areas. The Capital Development Authority (CDA) has set up filtration plants in Islamabad to provide safe drinking water to the residents and minimize waterborne diseases. To a certain degree these facilities have enhanced access to safe water but maintenance, reliability and service quality are still concerns. Inadequate supervision, infrastructure issues, and contamination risks at several of the filtration plants have been reported that affect the public's trust in the safety of its water supply (PCRWR, 2013). Households, therefore, resort to other sources of drinking water, such as bottled water, despite the extra expense.

A knowledge of willingness to pay (WTP) for improved drinking water services is crucial for the design of sustainable and efficient public service delivery systems. Willingness to pay indicates both the value that households place on safe drinking water and their willingness to pay for the water and for the maintenance of public infrastructure. Accurate estimates of WTP can help policymakers to determine the pricing policy, efficient resource allocation and better management of public water filters. Where funding for water supply services is

constrained the involvement of household members and contributions to the costs of services can be important in sustaining services over the long-term. Although water supply and water quality problems have increased in the urban areas of Pakistan, there is little empirical information about the willingness of households to pay for better service from the public filtration plant in urban Pakistan from a public service delivery angle. Most prior research has been conducted in the general context of water supply, or rural water supplies, while comparatively little has studied the impact of service quality, governance on household payments in urban contexts.

Hence, the purpose of this study is to analyse the willingness to pay for the better provision of drinking water services by public water filtration plants in Sector I-10, Islamabad. In particular, the study estimates the percentage of households willing to pay for better services. It characterizes the socioeconomic and service-related determinants of payment with the Contingent Valuation Method (CVM) and a binary logit regression model. The results of this study will be helpful to policy makers, service providers, and other stakeholders who want to increase the sustainability and quality of urban water supply systems in Pakistan and improve the quality management of water supply systems in general.

2. LITERATURE REVIEW

Safe and reliable drinking water is essential in public service provision and sustainable urban development. Poor water supply service quality and poor service quality in many developing countries has made the households relying on alternative water sources and their demand for better service has gone up. Estimating willingness to pay (WTP) for better water services has therefore been important in the design of sustainable financing options and, consequently, better service delivery, and has become an important tool for the policy makers.

A method that is widely used to estimate the economic value of non-market goods like safe drinking water is the Contingent Valuation Method (CVM). CVM allows researchers to assess preferences and willingness to pay for improvement in public services within the household. CVM has been proven to be a reliable and flexible way of assessing the value of public goods and conducting a cost-

benefit analysis in water supply systems (Cameron & Huppert, 1989; Whittington, 1998). The approach has been widely used in developed and developing nations to measure the demand for better water service and to find out socioeconomic factors affecting the willingness to pay.

There is a large and growing body of empirical evidence that suggests households are willing to pay for better drinking water services when the quality, reliability and safety of services are improved. In an urban Bangladesh context, for instance, Chowdhury (1999) found that households were willing to pay for safe drinking water services to meet the cost of improved water supply systems. Likewise, Casey, Kahn, and Rivas (2006) have found that residents in Brazil were willing to pay for better water services, even though the services were the same, due to their concerns about water quality and health risks. Based on this research, it is concluded that the quality of services and perceived health benefit are important in determining willingness to pay among the households.

In developing countries, several studies have found that inclination to pay for better water services is determined by income, education and awareness. Ahmad and Sattar (2007) found that there is a significant effect of education and awareness on willingness to pay for good quality drinking water in Pakistan. Similarly, Perveen et al. (2016) concluded that positive relationship exists between willingness to pay for safe drinking water services and income and awareness. The results show that socioeconomic factors play a crucial role in determining the demand of households in using better water supply systems. Empirical studies over the last few years have also highlighted the importance of service quality and behavioral factors in influencing willingness to pay for better water services. In Peshawar, Khan, Ahmad and Rahman (2020) carried out a study, and they concluded that communities are very dependent on the quality of municipal water services, but water quality is not satisfactory and as a result there is a need to improve the quality of the water infrastructure and its management. Likewise, Akhtar and Naveed (2024) found that income level is an important determinant of the demand for drinking water improvements among households in Lahore, with higher income households willing to pay for a more reliable water supply.

Other more recent studies have also examined the role that behavioural and institutional factors play in influencing willingness to pay. Hayat and Waqas (2025) conducted a study on the willingness to pay for improved water supply services among the households in Pakistan based on the information extracted from the national survey and revealed that income and access to water sources play a significant role in determining payment behavior. Furthermore, Ali, Rehman and Rafiq (2025) used the Theory of Planned Behavior approach to explore willingness to pay for clean drinking water, and found that households' attitudes and awareness towards the environment were important factors in determining their willingness to pay for better services.

Policy-wise, willingness-to-pay estimates are important to enhancing the sustainability of public water supply systems. According to Hussain, Ali and Khan (2018), CVM can help to deliver sustainable public services by providing better cost recovery mechanisms and resource allocation in water supply systems. The results point to the need to incorporate preferences of households into the water management policies for improved service quality and sustainability of water systems.

Although there is a vast literature available on WTP for safe drinking water, very little research has specifically focused on the effect of the quality of the water service on WTP for household water in urban centres in Pakistan, especially in the case of public filtration plant services. The majority of these studies have been undertaken in general water supply conditions or in the rural water systems, with few studies looking into the link between service quality, governance and household payment decisions in urban areas like Islamabad.

Hence, the present study aims to close this gap by investigating the impact of Water service quality on household willingness to pay for better water service for drinking water in Islamabad. The study provides empirical evidence on public services delivered at the public filtration plants, and considers the socio-economic and service aspects, which can be used for better public services delivery and sustainable water management in urban Pakistan.

3. METHODOLOGY

This research adopts a quantitative research design and investigates the effect of water services quality on

the willingness to pay (WTP) of households for better drinking water service in Islamabad. The primary data were collected from households of the residential area, Sector I-10 of Islamabad where several public filtration plants are installed for the supply of treated drinking water.

The study area was chosen as sector I-10, as this sector has a comparatively larger number of filtration plants as compared to other sectors of the city. The Capital Development Authority (CDA) revealed that there are five filtration plants in this sector which provide drinking water to households. Although these facilities exist, there are concerns about water quality, maintenance and reliability of services, making the area appropriate for the study of household demand for better services.

This study was based on primary data which was gathered by using a structured questionnaire given to the households in the selected area. The questionnaire included 46 questions to elicit information on household socioeconomic characteristics, existing sources of drinking water, satisfaction with current water services, knowledge of water quality and health risks, and willingness to pay for better water services. Closed and open-ended questions were used to get quantitative and qualitative data from the respondents.

The stratified sampling approach was employed to ensure that the sub-sectors in the study area were represented. Sector I-10 is divided into four sub-sectors: I-10/1, I-10/2, I-10/3, and I-10/4. Households were chosen from the three remaining sub-sectors of the residential sub-sector as the I-10/3 area is mostly an industrial district. There were 6,146 households across all of these sub-sectors. The number of households in a sample was determined to be 362 households at 95 percent confidence level with a 5 percent margin of error. The sample was drawn proportionately across sub-sectors and systematic random sampling was adopted to draw the sample.

The study used a widely used non-market valuation approach to estimate the economic value of an improved drinking water service, the Contingent Valuation Method (CVM). A hypothetical scenario was presented to the respondents depicting better water service quality and the question, "If the water service was improved, would you be willing to pay for additional improved services. If the initial bid

amount was accepted, a higher bid was made, if it was refused, an open-ended question was used to find the maximum bid that was accepted.

Household willingness to pay for better drinking water services is used as the dependent variable in the study and is dichotomised (coded 1=yes, 0=no). The study uses a binary logit regression model estimated by maximum likelihood methods to analyze the determinants of willingness to pay. The logit model is suitable, as the dependent variable is dichotomous, and the probability of a household being willing to pay for the improved services can be estimated.

The explanatory variables in the model are household income, education level, number of children, awareness of water quality and health threats, satisfaction with current water services, health status of the house and changes in water practices after awareness. The selection of these variables was justified on the basis of theory and findings from previous empirical studies on willingness to pay for water services.

The general model of Binary Logit Regression is:

$$\ln \frac{P(Y=1)}{P(Y=0)} = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \dots + \beta_n X_n$$

$P(Y = 1) = P_0$: Probability of HHs who are willing to pay

$P(Y = 0) = 1 - P_0$: Probability of HHs who are not willing to pay

In this study, the model will be as follows:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + \mu_i$$

$Y = 1$ for WTP ; $Y = 0$ for Not WTP

X = Variables

β_0 = Intercept

μ_i = Error Term

The combination of the Contingent Valuation Method and binary logit regression model offers a very strong tool for the analysis of household preferences and the main factors affecting the willingness to pay for better water service quality in urban areas.

4. RESULTS AND DISCUSSION

The results of the study are presented in this section using descriptive statistics and binary logit regression analysis. This study analyzes the perception of water service quality among all the households, the actual use pattern of water resources and factors affecting

willingness to pay (WTP) for better water service for drinking in Islamabad.

4.1. Descriptive Analysis

The reliability of the survey instrument was evaluated by Cronbach's alpha which was 0.70, suggesting that the survey instrument had acceptable internal consistency of the data. The descriptive results reveal that a considerable percentage of households get their primary drinking water source from use of public filtration plants. About 32.3% of respondents used water from the filtration plant, 28.9% used groundwater, 23.8% used bottled water and 15.2% used piped supply. The results indicate that filtration plants are an important source of water for household use in the study area.

Although filtration plant services are widely available, people are still more than 90% dissatisfied with the water quality. In general, 53.9 percent of respondents were dissatisfied with their current water source for drinking water, especially the filtration plant water. Twenty-two.4% of respondents thought the quality of water from the filtration plant was good and 27.9% thought it was poor. Additionally, 33.7% of respondents mentioned that the water from the filtration plant occasionally tastes or smells bad, which suggests a concern about filtration plant reliability and maintenance.

The results also show that clean drinking water is among the basic public services that are seen as a top priority. About 68.2% of respondents indicated that drinking water is their top priority among sanitation and solid waste management. This points to the need to enhance water service provision to address water demands and safeguard public health.

The willingness to pay analysis shows that a significant proportion of the households are willing to pay for better water services. Of the respondents, 89.2% were willing to pay for the improved filtration plant services, and 10.8% were unwilling to pay. The high level of willingness suggests high demand for reliable and safe drinking water services in the study area.

Socioeconomic factors that were important for the willingness to pay were income and education. The results show that households with higher income levels are more likely to pay for improved water services. For instance, families with income greater than Rs. Households with incomes less than Rs.

90,000 per month were the most willing to pay. 30,000 were not so ready to pay. Likewise, the willingness to pay rose with education, as higher education implies a greater knowledge of water quality and health risks of the household.

The willingness to pay changes also by type of family: The results show that households with children are more likely to be paying for better water services than those without children. About 78.2% of families with kids said they would be willing to pay, suggesting they are more concerned with child health and safety.

4.2. Willingness to Pay and Demand Relationship

The study also looked at household reactions to various payment options to estimate the demand for better water provision. The findings show that there is a negative relationship between price and willingness to pay. For a suggested monthly contribution of Rs. A smaller percentage of households, 500, were willing to pay. But with the contribution amount reduced to Rs. 250, Rs. 150, and Rs. The number of households willing to pay rose markedly to 50. This is the typical economic trend of price and demand: the lower the price, the greater the demand.

4.3. Binary Logit Regression Results

A binary logit regression model was estimated to determine the factors affecting willingness to pay. The results show that the variables of education, household income, number of children and awareness of the quality of water are statistically significant in predicting willingness to pay for improved water services.

The willingness to pay is positively associated with education level at the 5 percent level of significance ($p = 0.020$). The estimated odds ratio shows that households with higher levels of education are around 38 times more likely to be willing to pay for improved services than those with less education. This is consistent with previous studies indicating that education contributes to awareness of health risks from unsafe drinking water.

Household income is also positively and statistically significantly related to willingness to pay ($p = 0.033$). The findings imply that the likelihood of willingness to pay for better water service is positively related to household income. The odds ratio suggests that there is a roughly 32 fold higher probability that higher-

earned households are willing to pay for better services than lower-earned households.

Another statistically significant factor is the number of children in the household ($p = 0.050$). Households with larger families are more likely to be willing to pay for better water services because of their fear of health impacts and risks from water-borne diseases on children.

The willingness to pay is statistically significantly positively affected by water quality and health risks awareness ($p = 0.027$). Increased awareness increases the likelihood that households will understand the value of better water services and will thus be more inclined to make financial contributions.

Willingness to pay is negatively and significantly associated with satisfaction with current water services ($p = 0.024$), on the contrary. This suggests that households that are content with the water source they have are less likely to be willing to pay to improve water sources. Likewise, the health status ($p = 0.298$) and changes in water practices after awareness ($p = 0.376$) were determined to be negatively related, but not statistically significant ($p > 0.05$).

Overall, the regression model is well explanatory with the Nagelkerke R-square value of 0.861, which suggests that the chosen variables account for a significant portion of the variance in the households' willingness to pay for better drinking water services. The results point to the need for quality improvements in water service delivery, knowledge dissemination and improving infrastructure and maintenance problems to improve the engagement of households in sustainable water supply financing.

5. CONCLUSION AND POLICY RECOMMENDATIONS

The present study investigated the influence of water service quality on willingness-to-pay (WTP) for improved drinking water service in households in Sector I-10 of Islamabad, where public water filtration plants are extensively adopted. The study relied on primary survey information gathered from 362 households and secondary analysis of the Contingent Valuation Method (CVM) along with a binary logit regression model, which identified key socioeconomic and service-related factors that influenced household payment decisions.

The results highlight that there is a significant demand for better quality drinking water services, with around 89% of households willing to pay for improvements to filter plant services. This outcome is a sign of high awareness of public issues on water quality and the sustainability of existing water supply systems. Although filtration facilities are available, many households noted that they were not satisfied with the quality of services provided due to perceived inadequate maintenance, water quality and access to services.

The empirical results show that household income, education, number of children and awareness of water quality and health risk are statistically significant factors in the willingness to pay for better water services. Higher income and better-education households are more likely to make financial contributions to better services, due to financial ability and increased health risk awareness of the negative effects of unsafe drinking water. Likewise, families with larger children are willing to pay higher because they are more concerned with the health and safety of their family.

However, satisfaction with current water services, health status improvements and water practices changes following the awareness campaign were found to have negative relationships with willingness to pay. If a household is happy with the water source and/or has already implemented measures to ensure water safety, they are less likely to be willing to spend money on water services. The results point to the significance of service quality and public trust for the involvement of households in funding public utilities.

In general, the study findings suggest that efforts aimed at improving the quality of water supply services and increasing the trust by the public in the water supply quality can have a significant impact on household's willingness to participate in the sustainable water supply sources. The findings of the study also highlight the importance of good governance, maintenance and communication practices to provide reliable and safe drinking water provision in urban areas.

5.1. Policy Recommendations

On the basis of the results of this study, there are several policy recommendations that are proposed to

enhance the effectiveness and sustainability of public water service delivery in Islamabad.

First, it is important for public authorities, especially the Capital Development Authority (CDA), to give priority to the regular maintenance and monitoring of the filtration plants to provide reliable and good water quality. Boosting operational efficiency and improving infrastructure management can increase the confidence of the public in water services and boost household involvement in infrastructure improvement.

Second, there needs to be a clear and transparent cost sharing system which would enable households to pay for the maintenance and improvement of the filters. Results of this study suggest that there is a high willingness to pay for services, and community based financing models can help mitigate the burden on public budgets while delivering sustainable services.

Third, public awareness campaigns should be enhanced to raise household awareness about health risk from unsafe drinking water and benefits of improved water services. Greater awareness can foster responsible consumption of water, support preventive health measures and foster a greater willingness to pay for service enhancements.

Fourth, increasing the number of filtration plants in urbanized residential areas can help to enhance access to safe drinking water and decrease use of other sources of water that are not safe, like untreated groundwater. Infrastructure expansion should be accompanied with proper supervision and quality control measures.

Lastly, new service delivery models like community-based water systems or services to deliver water to households may help to overcome the problem of transportation and access. These can enhance service convenience, users' satisfaction level and achieve sustainability of the public water supply system.

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