DETERMINANTS OF HOUSEHOLD'S PREFERENCES FOR SAFE DRINKING WATER IN PAKISTAN

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Abstract

The availability of clean drinking water is referred as one of the basic human right, due to the fact that drinking of unsafe water results in various waterborne diseases especially diarrhea and hepatitis. Past studies indicate that most of the children (below the age of 5) in Pakistan suffer from four episodes of diarrhea and usage of safe drinking water has potential to significantly improve the situation. In the present study socio economic factors in determining the Pakistani household's decision for drinking water sources and adoption of water purifying methods at home have been analyzed. Study estimated the Multinomial logit (MNL) models on household data of Pakistan Demographic and Health Survey 2012-13. Study found that having small family, living in urban areas, being wealthy, being educated, having media exposure, less distance from water source, faced diarrhea by any family member in last four weeks and women empowerment are significant factors in utilization of safe or better quality drinking water in Pakistan.

Keywords: Safe Drinking water, Women Empowerment, Education, Awareness.

JEL Classification: D310, J160

Introduction

Inadequate and poor quality of drinking water is major health issue among developing countries. Because numerous deadly diseases particularly hepatitis and diarrhea are connected with drinking water's quality. According to WHO (2004) estimates approximately 1.8 million people dies every year due to diarrhea and majority of them (90%) are children. It was further concluded by the study that poor quality of water and sanitation is the major reason for 88 % of these fatal diarrhea illness. In view of that access to safe drinking water is acknowledged as basic human right (Jain, 2012).

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Note: The views presented in the paper are author's personal views and do not represent views of their affiliated institutions in any respect.

Improving the quality of drinking water will result in curtailing the water borne diseases and diarrhea (Fewtrell et al., 2005; Esrey et al., 1991; Esrey & Habicht, 1986). It has been found that during 1870-1930, by providing piped water to the urban areas, mortality rates had declined rapidly in USA (Cutler & Miller, 2005). However, such benefits can only be achieved if good sanitation facilities and hygienic condition are available (Brick et al., 2004 & Checkley et al., 2004).

The situation of access to safe drinking water in developing countries is unsatisfactory. According to the estimates of UNICEF and WHO, almost 780 million people of the planet are lacking access to safe drinking water (WHO/UNICEF JMP 2012). In Pakistan, Nils (2005) estimated that approximately 2 lac children die annually due to the diarrhea. It has also been concluded that due to human waste and contamination of industrial and agricultural pollutants water's quality in Pakistan has significantly deteriorated over the years and polluted water is the main reason of 60% of infectious waterborne diseases (PCRWR, 2012). The study also concluded that in different urban areas of Pakistan, due to closeness with sewerage lines the piped water is also polluted.

In Pakistan, people drink water from various sources including, piped water, hand-pumps, wells, tube wells, bottled water, ponds, fountains and rivers etc. Past studies on the issue indicates that household's decision to choose the source of drinking water is significantly affected by wealth of household head, education and level of awareness about hazards of using unsafe water by the household head, household distance from water source, size of the family, quality of the water (taste, odour etc.) and locality of household living in urban or rural areas(Haq et al.,2007; Rauf et al., 2015; Abrahms et al., 2000; Zulifqar et al., 2016).

In order to purify water at home, people adopt different methodologies like filters, use of charcoal and boiling etc.   Past studies on the subject found that cost of methods adopted to clean water, wealth of household head, education and level of knowledge about hazards of using unsafe water of household head plays significant role in selection of in-house water purifying methods (Bruce & Gnedenko 1998; Smith & Desvousges 1986; Jalan & Somanathan 2008; Quick et al., 1999; Mintz et al., 2001; Jalan et al., 2009). It was also concluded that wealthier and well educated household prefer to use comparatively expensive technologies (filters) for water purification (McConnell & Rosado 2000; Dasgupta, 2001)) However, it was argued that in comparison to education and awareness, wealth of household plays stronger role in decision making of adoption of water purification techniques (Jyotsna et al., 2003). It has also been concluded that households wherein female members are well educated tends to pay more for safe drinking water (Sattar & Ahmad, 2007).

In the present study drinking water sources and adoption of different water purifying techniques by Pakistani households will be analyzed. Study will also attempt to explore the role of different socio economic factors on the decision for using safe drinking water in Pakistan.

Methodology

Pakistan Demographic and Health Survey (PDHS) 2012-13 dataset have been used in the study. Over the years Demographic and Health surveys are conducted with the funding and assistance from USAID. A total of 12,943 households were interviewed in PDHS 2012-13.

As mentioned in introduction a household can get the safe drinking water by having access or using the treated water supplied by government/NGO/purchasing or household may treat the water at home. Checkley et al. (2004) and Brick et al. (2004) concluded there are likelihood that during storage and transportation of clean drinking water to the households' significant contamination can occur which deteriorates the water's quality. Therefore applying method to purify water at the time and point of its use is the more effective as compared to supplying/obtaining the treated water (Fewtrell et al., 2005). Colwell et al. (2003) found that in Bangladesh, very simple methods i.e. using old saris as water filter had successfully removed the harmful particulates (larger than 20 micron) from water, reducing the diarrhea by 45%, yet it failed to remove the bacteria. However if water is treated by boiling or using chemicals then bacteria can easily be eliminated (Mintz 1995; Quick et al., 1999).

The PDHS 2012-13 provide the data of household's drinking water sources and purifying methods adopted by them to make drinking water safe. In order to analyze the household's choice of the source of drinking water a Multinomial Logit (MNL) model has been estimated because dependent variables are multi-categories and they do not have any ranking or ordering. In the model base category is filtered/ bottled water.

Another multinomial logit model will be estimated to examine the household's preferences for water purifying methods and here no treatment will be used as base category. The independent variables of the analysis are household's income, education of household head, distance/time to reach water source, level of awareness of household head (proxied by Listening Radio, Watching TV, or Reading Newspaper), family size, household head's gender, family member facing diarrhea during last month, empowerment of women in the household and region (urban or rural).

Results and Analysis

In table 1, descriptive statistics of the explanatory variables have been presented. It suggests that approximately 46% of the households belong to urban areas, while majority are rural households i.e. 56%.

Table 1
Descriptive statistics of independent variables

Variable	Average	Standard Deviation	Minimum	Maximum
Region (Rural=0, Urban=1)	0.4653	0.4981	0	1
Household Head's Sex (Female =0, Male=1)	0.9142	0.2804	0	1
Household Head's age	46.6790	13.4142	14	95
Family Size	8.9082	5.1041	1	48
Education of Household Head	1.4290	1.1563	0	3 (High)
Wealth	3.0382	1.4234	1 (Top 20%)	5 (Bottom 20%)
Awareness (Listening Radio, Watching TV, or Reading Newspaper =1, 0 otherwise)	0.5063	0.4991	0	1
Distance to water source (Time to reach water source 15 minutes or more=1, 0 otherwise)	0.1744	0.3793	0	1
Women's Empowerment in purchasing Household items(Empowerment=1, 0 otherwise)	0.4031	0.4914	0	1
Incidence of Diarrhea (Diarrhea during last month=1, 0 otherwise)	0.1490	0.3561	0	1

Table also depicts that most of the households are headed by male (91%). Similarly, maximum age of the household head in the survey is 95 years while minimum age was 14 years, table also indicate that average age of the household head is 47 years. The maximum family size of the surveyed households is found to be 48 people. However, on average a family consists of 9 persons. It also suggests that approximately 50% of the households are either listening to radio or watching TV or they are reading newspapers, reflecting reasonable level of awareness. The table indicates that limited 17% of households are living in a place from where it took fifteen minutes or more to reach the water source. In 40% of the household's women enjoys autonomy in decision making for purchasing households items.

It is pertinent to mention here that in the survey seventeen different drinking water sources have been reported. Keeping in view the number of responses and nature of the sources they are clubbed into six water sources. Considering the bottled water and water obtained from filtration plant as the safe drinking water, in the first estimated model (Multinomial logit model) it is used as base category of water source.

Table 2
Estimation results (Drinking water source)

Variables	Water Sources				
	Piped Water	Protected well/ bore hole /Tube well	Springs/unprotected well	Streams/ River/ Cannels/ Lakes Dam/ Ponds	Carats/ Truck/Tanker
Region	0.3914*	-1.0391*	-1.3610*	-0.6483*	0.1692
Household Head's sex	0.1630	-0.1123	-0.8861*	-0.8162*	-0.7874
Household Head's age	-0.0011	-0.0060	-0.0012	-0.0114	-0.0113**
Family Size	0.0330*	0.0532*	0.6024*	-0.0713*	0.1021*
Education of the household head	-0.6481**	-0.0150	-0.0092**	-0.0914**	-0.1230**
Wealth of household	-0.7551*	-0.8910*	-1.4090*	-1.5513*	-1.1091*
Awareness (Media exposure)	-0.2623**	-0.3624*	-1.0664*	-0.6131*	-0.7983*
Distance to water source	3.2342*	2.3242*	-1.7273*	-0.6903*	-0.8161*
Women's Empowerment	-0.1143	-0.1311	-0.5304*	-0.8490*	-0.4272*
Constant	-2.2730*	4.3542*	4.7984*	4.0030*	2.0391*
LR Chi Square	5222.280*				

*$p < 0.05$;   **$p < 0.10$

The results suggest that place of residence (living in urban or rural areas) have significant impact on the choice of drinking water source in four out of 5 alternative sources. It indicate that there are significantly more likelihood that households belonging to urban areas will use piped water in comparison to bottled or filtered water (cost seems to be major reason). However, there are significant less likelihood that urban households will use the water from rivers, streams, tube wells, and wells for drinking purposes.

It has also been found that in two alternatives the household head's sex had played significant role, suggesting that there is less likelihood of using drinking water form unprotected wells, springs, streams, rivers and dams by the households that are headed by male. However, the household head's age failed to exhibit any significant role in determining the drinking water source.

The family size emerged as strong determinant of household's decision of using drinking water source because of the significant results for all the alternatives. It has been found that in four alternatives households having large family size prefers these sources over bottled water or water from filtration plants. Due to the fact that with large family size the requirement of drinking water also increases so using bottled water or water from filtration plant become unaffordable. However, even the households having large family size do not like to use drinking water from dams, river and streams.

Similarly, the education and awareness (media exposure) have significant role in household's decision to choose from alternative water sources. It has been found that well educated and having media exposure households do not (significantly) prefer to use water from different sources over bottled water/water from filtration plants. It reflect that with education and media exposure household that are aware about the hazardous impacts of using unsafe water prefer safe drinking water sources.

Study also found that wealthier households significantly prefer to use bottled and filtered water over different other alternative sources. Because wealthier households had affordability of high cost of bottled water, furthermore they are also more health cognizant and are ready to make extra expenditure on safe drinking water sources.

Distance to water source also play significant role in household's choice of the drinking water source. It reveals that likelihood of using drinking water from protected wells, piped water and tankers significantly increases if it took fifteen minutes or more for the household to reach filtration plant. It is also pertinent to mention here that households do not prefer to use drinking water from dams, unprotected taps or rivers even if it took time to reach filtration plant. In line with our expectations study had found that household's wherein women are having autonomy in decision making for the household purchases are significantly more likely to use bottled water or from filtration plants for drinking purposes.

As mentioned in methodology section, in the next step, household behaviour of using different methods at home for water purification have been analyzed. Data of seven different in home water purification methods adopted by the households is available in the PDHS 2012-13. Due to very limited observations the use of have been clubbed with few other methods as others. Here the no treatment has been used as base category and Multinomial Logit (MNL) model is estimated. The results are present in table 3.

Table 3

Estimation results (use of water purification methods at home)

Variables	Water Purifying Methods			
	Boiling the water	Using cloth as filter	Electric Water Filters	Chlorine tablets and Others
Household head's sex	-0.1042	0.2984	0.4780	0.3223
Region	1.1593*	0.8890*	1.6001*	0.7723*
Household head's age	-0.0031	0.0020**	0.0092	-0.0143
Family Size	-0.0573*	-0.0034	-0.0293	-0.0550**
Education of the household head	0.1332*	0.8601**	0.5721*	0.1141**
Wealth of household	0.7390*	0.0342	1.2760*	0.5912*
Awareness (Media exposure)	0.0793*	0.2071**	0.2083**	0.5962**
Women's Empowerment	0.0113**	-0.1374	0.6182**	-0.0784
Diarrhea Incidence during past month	0.0741**	0.1220**	0.5672	0.1963
Constant	-7.0223*	-5.4562*	-15.1954*	-9.6250*
LR Chi Square	1513.590*			

*p < 0.05;   **p < 0.10

These results suggest that household's place of residence is a significant factor in using the water purification methods. The urban households are more likely to adopt in house water purification methods in comparison to rural households. Study further reveals that urban households have a preference of using the electric water filters at home followed by boiling and using cloth as filters to purifying water. However, study unable to find any significant impact of sex of the household head on adoption of water purifying methods at home.

However, the age of the household head has significant impact on adoption of water purifying methods at home in one alternative (cloth filter). It suggests that household headed by more aged ones prefer to use the cloth as filters to purify water at home. Similarly size of the family is having significant and negative impact for the two alternatives (boiling water and use of chlorine tablets) out of four different alternatives. The possible reason is rather straight forward that with increase in family size, water requirements also increases and it may not be possible for these families to use filters. Therefore, they prefer not to use in home water purifying methods.

In line with the findings of first model it has been found that education and awareness (proxied by media exposure) have significant and positive impact on the adoption of in house water purifying methods (for all the alternative methods). Study also finds that households having awareness of hazards of using unsafe water have preference of using electric water filters at home followed by using cloth as filters and boiling water.

Similarly study also found that wealthier households significantly prefer to adopt electric water filters followed by boiling the water and using chlorine tablets to purify the water at home. However, there is no significant relationship of wealth on using cloth as filter for water purification. The empowerments of women also have significant and positive relationship with adoption of boiling and using electric filters to purify water at home. On the other hand, women empowerment failed to exhibit any significant impact on using cloth as filter and adoption of chlorine tablets to purify water at home.

The incidence of diarrhea by a family member of the household during last month have positive and significant relationship on adoption of boiling water and using cloth as filter to purify the water at home. However, it failed to portray any significant impact on use of electric filters and other alternative methods. It can be inferred that occurrence of diarrhea leads households to adopt only short term water purification methods at home.

Conclusion and Policy Implications

Unsafe drinking water is a critical health issue in developing countries because it results in different fatal diseases particularly hepatitis and diarrhea. According to the WHO (2004) estimates, diarrhea is main cause of the deaths of approximately 1.8 million people per annum, out of which 90% are children. Furthermore, unsatisfactory conditions of water and sanitation are the main reason of 88 % of these deaths. Significance of safe drinking water for wellbeing of the society is the basic motivation in conducting the present study.

Study reveals that size of the family, residence in in urban areas, education of the household head, awareness about hazards of unsafe water (proxied by media exposure) by the household head, empowerment of women in household and distance to water play significant role in household's

decision of choosing drinking water source. Similarly, wealth , residence in urban areas, size of the family, education of the household head, awareness about hazards of unsafe water (proxied by media exposure) by the household head women empowerment in household and the incidence of diarrhea by family member during last month have significant impact on household's decision for adopting in house water purifying methods. However, study is unable to find significant impact of sex and age of the household head on adoption of in house water purifying method and choice of drinking water source.

Study provides insight to the policy makers in terms of household's socio economic characteristics that become an obstacle for them in getting safe drinking water or to purify it at home. By using this analysis policy makers can take initiatives to target these segment of the population to improve the situation of safe drinking water in Pakistan. It was found that level of awareness and education of the household head are highly significant determinants of decision of using safe drinking water source as well as adoption of water purifying methods at home, therefore it is strongly recommended that government should launch awareness campaigns on media on regular basis about hazards of using unsafe water for drinking purposes along with benefits of using simple purifying methods at home. Study also reveals significance of women empowerment in household matters and recommends that efforts through legislative process must be made to empower women it would not only be beneficial for economic development (Akram, 2018) but it would also help in increasing the usage of safe drinking water in Pakistan.

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