Original Article

Access to Water and Awareness about the Unsafe Water in Rural Bangladesh

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Abstract

Introduction: Access to drinking water is a fundamental concern for many countries, including Bangladesh. Drinking of unsafe water might result to cause diseases and illness which heightens the economic burden for every one by increasing the treatment costs and work days lost. In Bangladesh, rural households coupled with the lack of safe water, also faces water-contamination with arsenic and other pollutants.

Objective: This study explores the status of the rural people in accessing the water for households. It also determines their knowledge regarding the contaminated water.

Methodology: The current study used retrospective data from Bangladesh Rural Advancement Committee's (BRAC) Research and Evaluation Division's baseline survey which was initiated under the 'water, sanitation and hygiene' program. Data was taken from 16,052 households between November 2006 and June 2007. Descriptive statistics were used to report the study findings.

Results: Approximately 67% of the households had a permanent water source and majority had their deep tube well. A major proportion of the household respondent (70%) identified the method properly to purify polluted water. About 41% households used tube well as a source of water for daily purposes, i.e., drinking, cooking, washing utensils, and bathing. Majority (85%) of the households were found to pay willingly for a good source of water. Households with the non-governmental organization (NGO) membership were willing to pay even more for the safe water as compared to households without NGO membership.

Conclusion: Respondents had considerable knowledge and awareness concerning the contaminated water. The association of NGO membership and level of awareness presented in this study should be of particular interest to the policy makers.

Keywords: Health, Awareness, Knowledge, Rural Bangladesh.

Introduction

Globally, 4% of all deaths and 5.7% of the total burden of diseases in DALYs (Disability Adjusted Life Years) lost due to diarrhoea and other water related infectious disease which is attributable to water, sanitation, and hygiene [1, 2]. Unsafe water situation and poor sanitation facilities in Bangladesh accounts for estimated three-quarters of all disease burden [3]. People who live in an urban area can get more access to the safe water. Globally 78% of the total rural population has sustainable access to safe drinking water when compared with 85% of the urban population in 2006 [4]. Acute scarcity of drinking water is prevalent in Bangladesh, even though the country is

renowned for its profusion of water which comes from different rivers. After the first instalment of a deep tube well in the 1940s, the number of tube well utilization has increased over a period of last two decades until 1993, when it became a suspect of arsenic contamination **[5]**. Over the decades, different health hazards, i.e., neurology, pulmonary diseases, skin lesions and cancer among the rural people have emerged due to ingestion of contaminated arsenic water. According to the commendation of United States Environmental Protection Agency, the presence of arsenic in drinking water is acceptable up to a level of 0.01 mg/litre or 10 parts per billion (ppb). However, more than thirty million people were disclosed to arsenic taint above fifty ppb, and another 46-57 million were exposed over 10 ppb in rural Bangladesh **[5]**. According to NGO forum report, only 74% of the country's total population had access to the drinking water which is free from arsenic and pollutants.

Drinking water contaminated with the arsenic particles has raised the health concern for inhabitants residing in arsenic affected areas, and evidence suggests that it may lead to water borne infections. According to a report from World Health Organization (WHO), people who took high arsenic contaminated water had developed arsenic-induced skin lesions. These skin lesions were prominent on the upper chest, arms and legs. Features of developing keratosis of the palms and soles were also frequent. In Bangladesh, groundwater with arsenic contamination was detected in 59 of the 64 districts, and 249 of the country's 463 sub-districts **[6].** A recently published report found that 38,500 people succumbed to death and about 70 million inhabitants confront a direct threat to develop the arsenic related illness. About 1.4 million tube-wells were encountered to hold arsenic above the normal level, and some of the inhabitants were using the contaminated tube-wells due to lack of alternative water source. However, individuals' decision to avoid arsenic exposure was positively affected by the socioeconomic status, i.e., education and income level. The incidence of experiencing diarrhoea and other water borne infectious diseases was seemed to be higher despite having a low case fertility rate **[2, 7].** As arsenic contamination co-exists with the other pollutants, ~90% of the children below the age of 5 years had suffered from diarrhoea due to ingestion of unsafe water **[8, 9].** Mostly, the poor households and urban slums were exposed to drinking water contaminated by arsenic particles, coupled with lack of access to alternative safe water sources **[10].**

Furthermore, the technologies adopted or introduced to ensure unsafe drinking water into safe from arsenic contamination, were the only immediate solutions available which were deemed costly for a developing country like Bangladesh **[11].** National sanitation status was published in June 2007 which reported that for treating the arsenic and water-borne diseases around USD 618,048,000.00 was spent in Bangladesh **[5].** Therefore, a large number of deaths and illness takes place both globally and in Bangladesh due to inadequate knowledge of safe water or inaccessibility to drinking water **[12].** Adequate knowledge of drinking water and awareness to use a good source of water can be a useful public health intervention which can avert many health related problems globally. The current study aims to determine the rural household's level of access to a drinking water source during different seasons (dry and rainy) of a year and assess household's awareness and knowledge about safe drinking water in rural Bangladesh.

Methodology

Study Area and Data Source

This study uses a retrospective data collected from Research and Evaluation Division (RED) of Bangladesh Rural Advancement Committee (BRAC). With an objective to achieve Millennium Development Goals target 4 and 7 of reducing child mortality and halving the number of people who are devoid of safe drinking water by 2015, BRAC with the technical and financial support from the Netherlands initiated the 'Water, Sanitation and Hygiene' Program in 2006 **[13].**

A baseline survey under the WASH program was carried out from November 2006 to June 2007 to assess the current situation of the water and sanitation status of the households. Data from the 16,052 households were taken from 32 sub-districts purposively based on geographical variations. One educated (at least passed the secondary level of education) adult member of each household was interviewed. Equal number of males and females were included.

The sample size estimation to initiate the household (HH) surveys adopted a multi-stage sampling technique where each sub-district was studied as a cluster. The estimated sample size was allocated among thirty villages of each sub-district where the interval-sampling technique was applied in selecting the villages. Villages under a sub-district were listed in the first stage, while within a sub-district were divided by 30 to compute the interval size in the next stage. The initial village was picked up randomly from the first interval where the rest were selected based on interval size. Apart from this method additional seventeen documents were retrieved from the databases of several national and international peer-reviewed journals from 1996-2017 timeline.

Variables and Measurements

Data was collected on "Access and status of water supply, sanitation, hygiene related knowledge" amongst the inhabitants. Spot observation by the enumerator was conducted in gathering information on sanitation facility, and water source which were nearby to a household. In addition to the above information, data regarding household's willingness to pay for a drinking water and facility for hygiene sanitation were also collected. Presence of membership card to an HH was used to confirm the NGO's accession. Water has been considered as safe when it is drinkable and has been collected from the deep tube well in this study. We have used an awareness index to identify the awareness status. This study took into account of 14 different independent disease and health awareness variables for building the awareness status. The disease variables included respondent's awareness about having proper knowledge of arsenic diseases and other diseases caused by polluted water. Safe water awareness was defined based on the ability of respondent's knowledge on how to purify the polluted water and prevent water borne diseases.

Data Management and Analysis

Skilled data operators were used for data entry, and collected data was stored in a SQL server. Inconsistent data was cross-checked and verified by the data management team. For creating an awareness index, standardization of the variables was considered so that values have a mean zero and standard deviation. This study created three different quartiles to find out the awareness index and grouped the participants as low awareness, medium awareness, and high awareness. Descriptive statistics were used to present the study findings. Stata version 13 was used to execute all the analysis.

Results

Water Source Scenario

The surveyed HHs relied on a different type of water source for drinking, cooking, washing utensils, and bathing during the dry and rainy season. Water sources were classified according to the types of tube well (hh's own tube well), shared tube well, supply water, and other sources which include public tube well, river, canal, pond, ditch, machine driven tube well, shallow machine, deep tube well, rain water and tap water from the nearby school, college, and mosque.

In the dry season, own tube well was used as a primary source for washing utensils (41%), bathing (37%) and after defecation purposes **(Figure 1).** The second main source for washing utensils (37%), bathing (28%) and after defecation (37%), was a shared tube well.

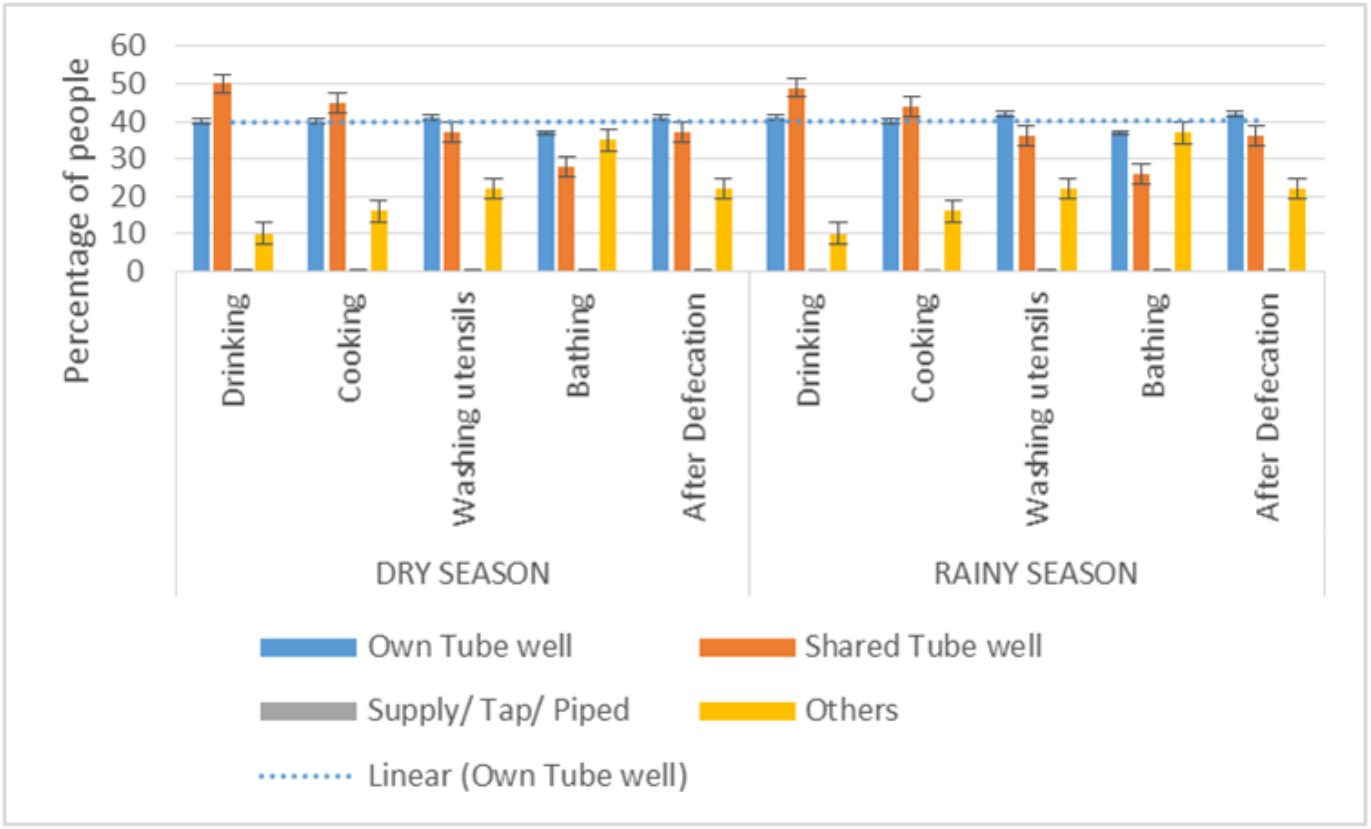

Figure 1. Distribution of Water Source Type (%)

We have found that shared tube well was the principal source of drinking water (49%) in the rainy season followed by own tube well (41%) and other water sources (10%). Moreover, for the purpose of cooking, the majority of the households (44%) used a shared tube well for collecting water (Table 1). The second primary source for cooking water was own tube well (40%).

Disease Awareness related to Unsafe Water

Majority of the households (69%) had information of arsenic particles, 33% of the respondents could name at least one disease associated with arsenic and only 1% could tell or in other words were found to be aware of two diseases related to arsenic. Major proportions (93%) of the respondents were aware of at least one disease caused by polluted water. Also, more than half (57%) of the participants were aware of two disease which can cause due to polluted water, and a considerable number of respondents (22%) were aware of three diseases caused by polluted water. However, only a small fraction of the interviewees (6%) could name a fourth disease **(Table 1).**

Variable	Mean	SD
Name one arsenic disease a	0.33	0.47
Name a second arsenic disease	0.01	0.12
Name a third arsenic disease	0.07	0.03
Name one disease caused by polluted water	0.93	0.25
Name a second disease caused by polluted water	0.57	0.50
Name a third disease caused by polluted water	0.22	0.41
Name a fourth disease caused by polluted water	0.06	0.23
Name a fifth disease caused by polluted water	0.01	0.09
Name a sixth disease caused by polluted water	0.017	0.04
Name a seventh disease caused by polluted water	0.002	0.01

Table 1. Selected Variables for creating index: Disease related Variables (n=16,052).

*Number of observations 16,052; SD: Standard deviation (a If the respondent could name = 1; otherwise =0)

Major proportion of the household respondent (70%) could tell a proper method to purify polluted water, while 74% were aware of any prevention method that could be used to avoid water borne disease. However, a small proportion (6%) of the respondent was aware of a second method to prevent water borne disease **(Table 2).**

Variable	Mean	SD
Have heard about arsenic problem	0.69	0.46
How to treat/purify polluted water	0.70	0.46
Tell a way to prevent water borne disease	0.74	0.44
Tell the second way to prevent water borne disease	0.06	0.23

Table 2. General Awareness Variables

*(Number of observations 16,052; Minimum 0; Maximum 1; SD: Standard deviation; If yes = 1; otherwise=0).

Figure 2 shows the distribution of the awareness group. About 33% of the HHs had lack of considerable knowledge about arsenic related diseases and polluted water, and possible prevention techniques; 36% of the households had a medium level of awareness, and 31% had high awareness level.

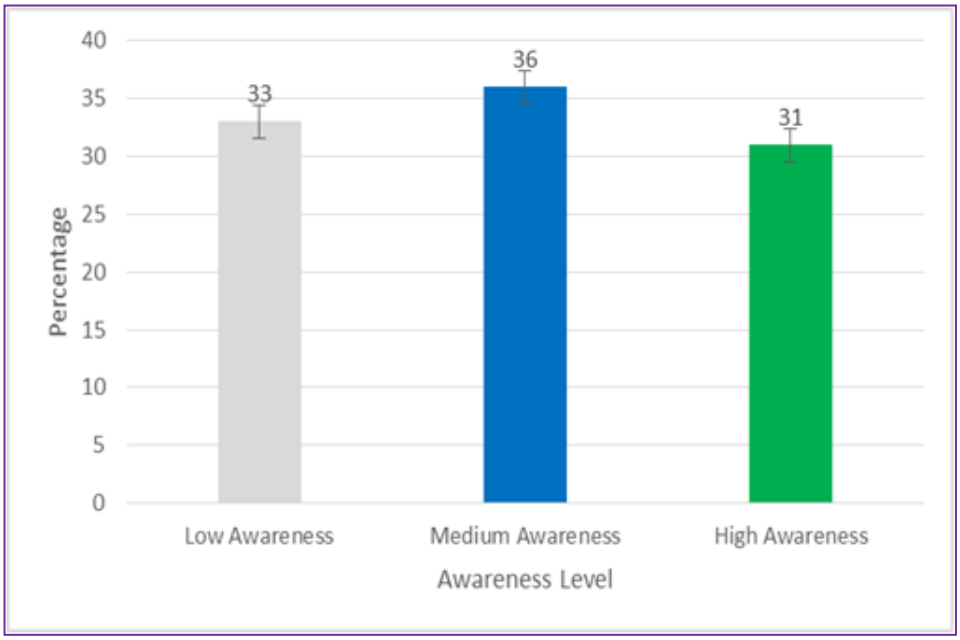

Figure 2. Distribution of the Awareness Group

Willingness to Pay (WTP) for a New and Safe Water Source

Figure 3 depicts the households mean monthly willingness to pay for different water source with and without NGO membership. Of all the households, 45% were found to be member of an NGO. Approximately 85% of the surveyed HHs was willing to pay from their own pocket for tube wells

which would be their ones. However, 15% of the HHs was determined to pay less than USD 0.35 per month for a new water source.

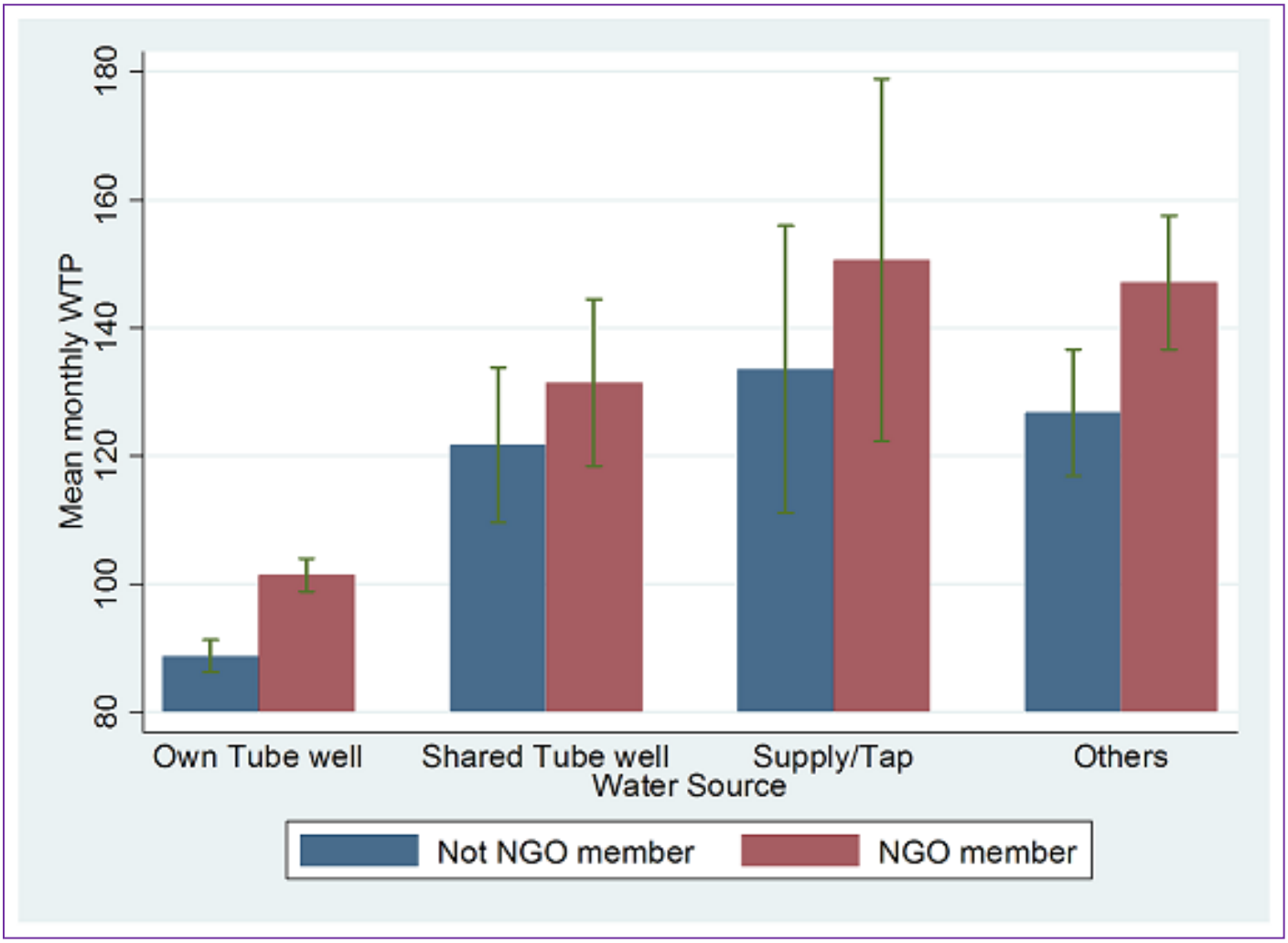

Figure 3. Mean Monthly WTP by NGO Membership

The household's willingness to pay for a new own tube well increased as we moved from low awareness level to a high awareness level **(Figure 4).** Concerning other three sources, WTP is the lowest for households who have low awareness, and WTP bid is highest for households who fall in the medium awareness group.

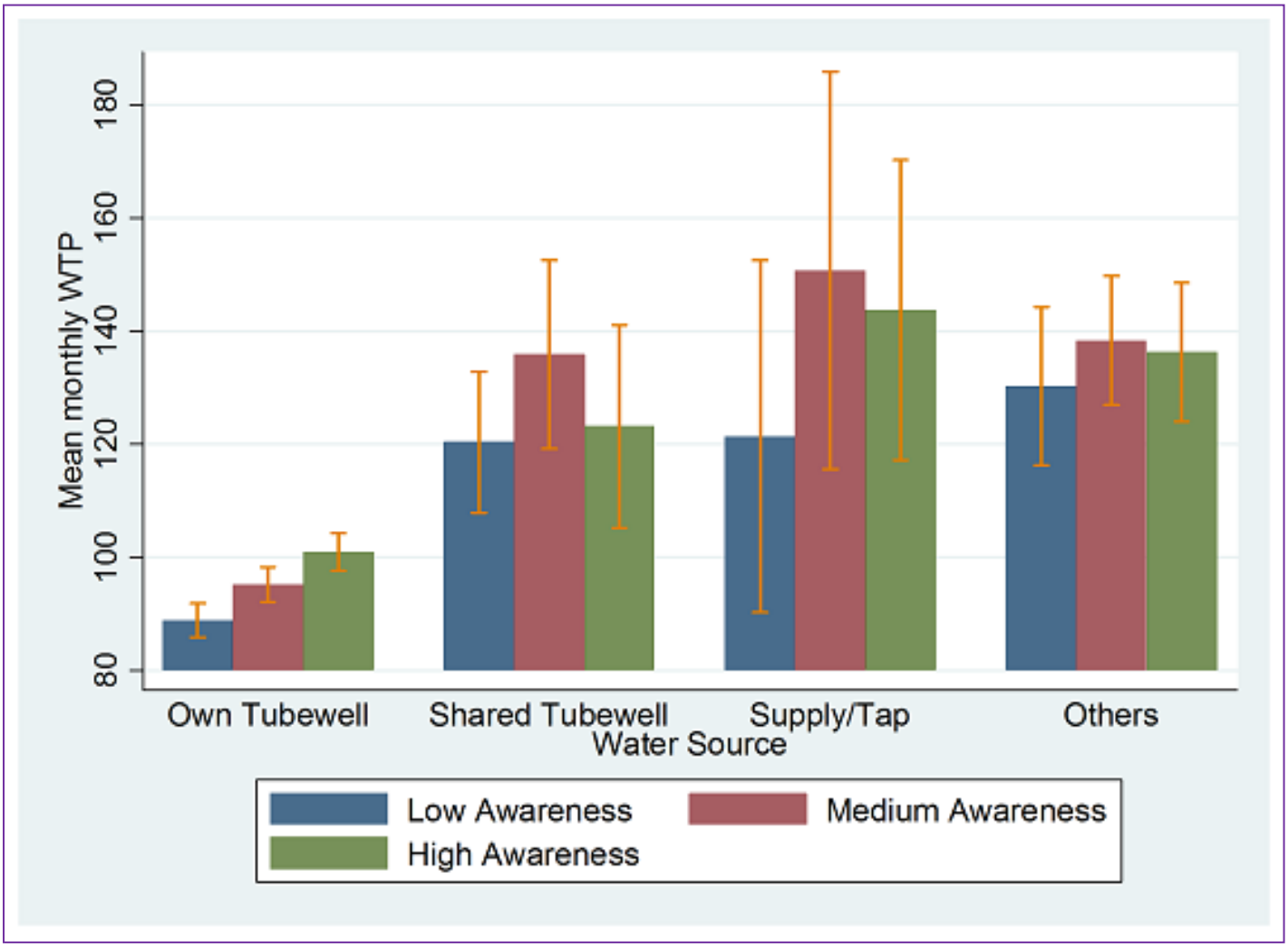

Figure 4. Mean Monthly WTP by Awareness Group

Discussion

This study found that households who had NGO membership had a mean monthly willingness to pay for a new and safe water source higher as compared to those households who did not have any NGO membership. This can be attributed to the recent NGO activities for promoting and campaigning of clean water, hygienic sanitation and raising awareness related to disease and prevention methods over contaminated water. Moreover, this study has noted an inconsistency of WTP among the participants for different water sources other than who used water from their own tube well. This might be because of the rise in awareness level; the respondents know that irrespective of the source of water, diseases caused due to water can be prevented or avoided if proper measures (such as boiling, treating water) were taken.

The current survey found that rural HHs of Bangladesh mostly use a shared tube well for drinking and cooking related purposes during both the dry and rainy season. While most of the households were found to use own tube well as a water source during the dry season for washing utensils, bathing and after defecation purpose, this study witnessed inequalities exist among the households. Previous study found that around 89% of the total population had access to drinking water and 63%

had access to use improved sanitation in 2010 [14]. Globally several countries adopted programs related to safe water, sanitation and hygiene [15] and reported considerable development for better access to drinking water and hygienic sanitation. However, this development has reported to lead to a higher level of inequity among the rich and poor [16]. Urbanization along with continued growth of population also stains the water and deteriorates sanitation infrastructure [17].While 67% of the rural HHs were listed to get a permanent water source, only 35% of the household reported to have their own tube well as a permanent water source.

The current study highlights people's knowledge and awareness about availability and use of safe water. Major proportion (85%) of the surveyed households were willing to pay for a new own tube well. Expenditure on drinking water might be associated with good health which consequently prolongs the life expectancy of a citizen [18]. For example, previous studies found that large scale of antibiotic resistance was discovered in villages where sanitation and drinking water were not adequate due to *Escherichia coli* contamination in water sources [19-21].

The association between the NGO membership and the level of awareness presented in this study should be of particular interest to the policy makers. Households that were a member of NGO desired a higher willingness to pay for a new and safe water source. Moreover, households showing more awareness about diseases and considerable knowledge about preventive measures of contaminated water expressed a higher willingness to pay for a safe water source. Policy makers and public health leaders should use the networks of NGOs to spread out more health information about diseases caused by unsafe water and make rural people of Bangladesh more aware of the threats it possesses [22]. There is a saying, "water is life" rather water is taking lives. If water is not clean, then it affects the longevity of the public, agriculture, and economic development of the country. It is well documented that rain water can and should be collected as an inexpensive (although limited) alternative. The government may support filter technology as another low-cost option. A bigger tragedy is that, despite the passage of times, there are very little fresh initiative has taken so far to lead a massive social and environmental movement to access the adequate drinking water sources [23]. To the best of the researcher's knowledge, this was the first study of this kind to report the households stand in accessing the drinking water and the HHs willingness to pay for a good water source. It also evaluated attitude and knowledge of the participants regarding the contaminated water and how they deal with it in their daily use.

Limitation and Strength of the study

This study did not use a comprehensive demographic and socioeconomic variable to check the correlation of awareness of water safety. Data were collected from the rural area settings, and it might not be representative of whole Bangladesh. We were not able to consider accurate technological advancement of water and hygiene system in some of the rural areas of Bangladesh. However, large sample size, well study design, and quality data were the strength of this study.

Conclusion

Respondents had considerable knowledge and awareness of the contaminated water. Most of the respondents were willing to pay for a good source of water. Therefore, both governmental organizations and NGOs should initiate projects related to install a safe-water source for the rural households. These households are most likely able to pay the cost of installation on monthly payment basis.

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FSC, SBZ, and SAIM drafted and edited the manuscript and contributed intellectually. All authors have read the final manuscript and agreed for submission.

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