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Comparative Status of Safe Water Use and Hygiene Practices in Areas with and without NGO-led Water, Sanitation and Hygiene (WASH) Programme

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EXECUTIVE SUMMARY

INTRODUCTION

More than 90% people in Bangladesh have access to improved water supply system, but arsenic is posing a threat to this achievement. Additionally, hygiene is considered as one of the challenging areas to deal in the development sector. A number of organizations (both government and non-government) are working to improve the water supply, sanitation and hygiene practices through various water, sanitation and hygiene programmes.

OBJECTIVE

The overall objective of this study is to reveal the role of non-government organizations (NGOs) in improving safe water use and hygiene practices by the rural people of Bangladesh.

METHODS

Ten *upazilas* with both NGO-led sanitation programme intervention and without any such activity (Comparison group) were selected for the study. Among the study *upazilas*, four were comparison *upazilas*, three were with BRAC facilitated WASH programme intervention areas and the rest three were with other NGO-led intervention areas. A multistage 30-cluster sampling method was adopted and 420 households were selected randomly from every *upazila* for the survey. In selecting 30 villages from every *upazila*, interval-sampling method was used.

KEY FINDINGS

1. Tubewell water was used predominantly for drinking in the study areas. Significantly higher proportion of households in the BRAC WASH areas used tubewell water for drinking than the comparison and other NGO intervention areas ($p < 0.001$).
2. The expenditure for tubewell drilling was mostly covered by self arrangement (95.1%) in the study areas. However, in BRAC WASH intervention areas 1.2% and in other NGO-covered areas 1.1% tubewells were financed by NGOs. Households not having their own tubewell mentioned financial problem (90.8%) as the major reason for not being able to install tubewell.
3. Overall knowledge about the demerits of using arsenic-contaminated water in the comparison areas was found less than the NGO-led WASH intervention areas. Regardless of the NGO-facilitated WASH programme prevalence, social institutions (54%), NGOs (23.5%) and mass media (26.6%) were the most common sources of information for knowing the demerits of using arsenic-contaminated water.
4. Significantly higher proportion of people in NGO intervention areas (either BRAC or other NGOs) mentioned to wash hands during critical times than the comparison areas. The overall hygiene practice among the households in the other NGO intervention areas with regard to all relevant issues was found higher

than the BRAC WASH and comparison areas, since less proportion of respondents mentioned not to know about the hygiene issues ($p < 0.001$).

5. Respondents from all intervention areas strongly opined for the necessity of NGO-led WASH programme for the improvement of safe water use (95.1%) and hygiene (95.8%) practices.
6. While asked about the source of information regarding safe water use and hygiene practices social institution and mass media were found predominant among all intervention areas. However, in areas with WASH programme intervention the respondents also mentioned NGO as a major information source.

CONCLUSIONS

The overall status of use of tubewell water and hygiene practices was found better in the NGO-led WASH intervention areas than the comparison areas. People mentioned about the effects of NGO interventions on the improvement of use of safe water and hygiene practices through the support for tubewell installation, arsenic testing, motivation and raising awareness through the village level committees organized by the NGOs. Majority of the respondents mentioned about the necessity of NGO intervention for ensuring 100% safe water use and hygiene practices. However, it needs more support (both tubewell supply and awareness activities) from the NGO targetting the illiterate, poor and ultra poor households.

INTRODUCTION

Quality and quantity of water, combined with reduced exposure to disease pathogens through better sanitation and improved hygiene behaviour not only improves the individual health, but also improves the community productivity. Depending on the region, huge savings in healthcare costs and gains in productive days can be realized by improving access to safe water, amounting to 2-7% of the gross domestic product or even more (UNICEF 2010). Water-related diseases eventually remain as one of the most significant child health problems worldwide through premature death, causing non-fatal chronic conditions such as diarrhoea, worm infections, cholera, malaria, trachoma, etc. (Save the Children 2009). The Joint Monitoring Programme (JMP) report of WHO/UNICEF (WHO and UNICEF 2010) reported that the world was on the track to meet or even exceed the drinking-water target of the Millennium Development Goals (MDG). Thus, although Bangladesh is on track to achieve the MDG target for access to safe drinking water but 20 million people are still drinking arsenic-contaminated water (UNICEF 2010). Till date the country has not yet been able to achieve 100% coverage of safe water supply. However, different sources show variable national coverage of safe water supply. The national coverage of safe water has been reported to be 97% of the total population (LGD 2008), while WHO/UNICEF mentioned 80% (WHO and UNICEF 2010). Access to safe water is hindered in the country by a number of reasons such as arsenic contamination, increased groundwater salinity in the coastal belt, declining groundwater levels, natural disasters, etc. (UNICEF 2010). Since 1996, Bangladesh government through the Department of Public Health and Engineering (DPHE) is testing tubewells for arsenic (UNICEF 2000). Additionally, around 700 NGOs are active in water and sanitation sector, with international, national, and small local NGOs commonly working in partnership (World Bank 2006). The NGOs provide hardware (installing tubewell, digging well, provisioning arsenic and iron filters, pond sand filters, etc.) and software supports (awareness raising, training, technical support, etc.) to the poorer sections of the community.

Water is very much related with personal hygiene, which eventually plays a significant role in hygiene practices (WASH RESEARCH TEAM 2008). Hygiene is commonly understood as preventing infection through cleanliness. It is the practice of keeping someone and his/her surrounding clean to prevent illness or the spread of diseases. More elaborately, it refers to the procedures or activities of preventing diarrhoeal diseases through the widespread adoption of safe hygiene practices, which begins with and/or is built on what local people know, do and want to do (UNICEF 1999). Hygiene practices are often regulated by cultural values and religious perspectives as well as ideas of purity and pollution (Ahmed 2008). There might be additional relation to the aspects of sanitation (defecation practice) and safe disposal of feces, household waste management, domestic and environmental hygiene, source, transport, storage and consumption of water, hand-washing with soaps, etc. (Harvey *et al.* 2002). Hygiene practices influence the transmission of soil-based diseases, skin diseases and disease transmitted by insect vectors and largely diarrhoeal diseases (Harvey *et al.* 2002). Diarrhoea alone is responsible for 2.2 million deaths, mostly under five children (1.7 million) and about 4.3% of the total global disease burden (WASH RESEARCH TEAM 2008). It is fascinating that only the behavioural change like hand-washing with soap can reduce the number of diarrhoeal episodes by 35% (Appleton and Wijk 2003). Unsafe water and human excreta are the main elements for

transmission of 40 diseases out of 50 prevalent in Bangladesh, including diarrhoea, dysentery, typhoid, parasitic worm infestation, measles and polio (WAB 2003). Like safe water and improved sanitation practices, improved hygiene practices contribute to reduce sickness and death of the people from water- and vector-borne diseases. Hygiene-related disease in Bangladesh costs 5 billion taka (US\$ 80 million) each year for treatment alone (WAB 2003). Thus, there is no alternative of promoting hygienic practices for individual and national gain.

The promotion of better hygiene alone or in combination with better water supply and/or sanitation can have a major impact on reducing disease prevalence and public and private health costs (IRC 2008). In Bangladesh, hygiene is considered as one of the challenging areas to deal in the development sector. Like water and sanitation a good number of governmental organization (GO) and non-governmental organizations (NGOs) are working to improve the hygiene practices either only through promotion of these practices or through the broad Water, Sanitation and/or Hygiene (WASH) programme. The government has decided to prepare hygiene messages for those *Union Parishads*, where 100% latrine coverage has been achieved. However, before mid 1980s hygiene promotion was not addressed adequately by any organization working in WASH sector (Ahmed 2008). BRAC started hygiene promotion, since 2006, more rigorously and comprehensively with its WASH programme. Later in 2007, UNICEF and DPHE jointly started similar initiative through a project called Sanitation, Hygiene Education and Water Supply Programme in Bangladesh (SHEWA-B) (Ahmed 2008). BRAC is doing this with the help of its own staff while SHEWA-B is being performed by local level NGOs. NGO Forum For Drinking Water Supply and Sanitation has been working since 1982 and they have more than 600 partner NGOs working on hygiene promotion in the country (Ahmed 2008). NGOs in Bangladesh are playing significant role in implementing development programmes and their role in sanitation has been reported in several studies (Ghosh *et al.* 2011; Hadi 2000; Hadi and Nath 1996). Hence, this study is an endeavour to compare the status of safe water use and hygiene practices in the areas "with" and "without" NGO-led programme interventions, which might help to depict the role of NGOs in improving the relevant national status.

OBJECTIVE

The overall objective of the study is to reveal the role of NGOs in improving the use of safe water and hygiene practices by the rural people of Bangladesh.

METHODS

RESEARCH TYPE

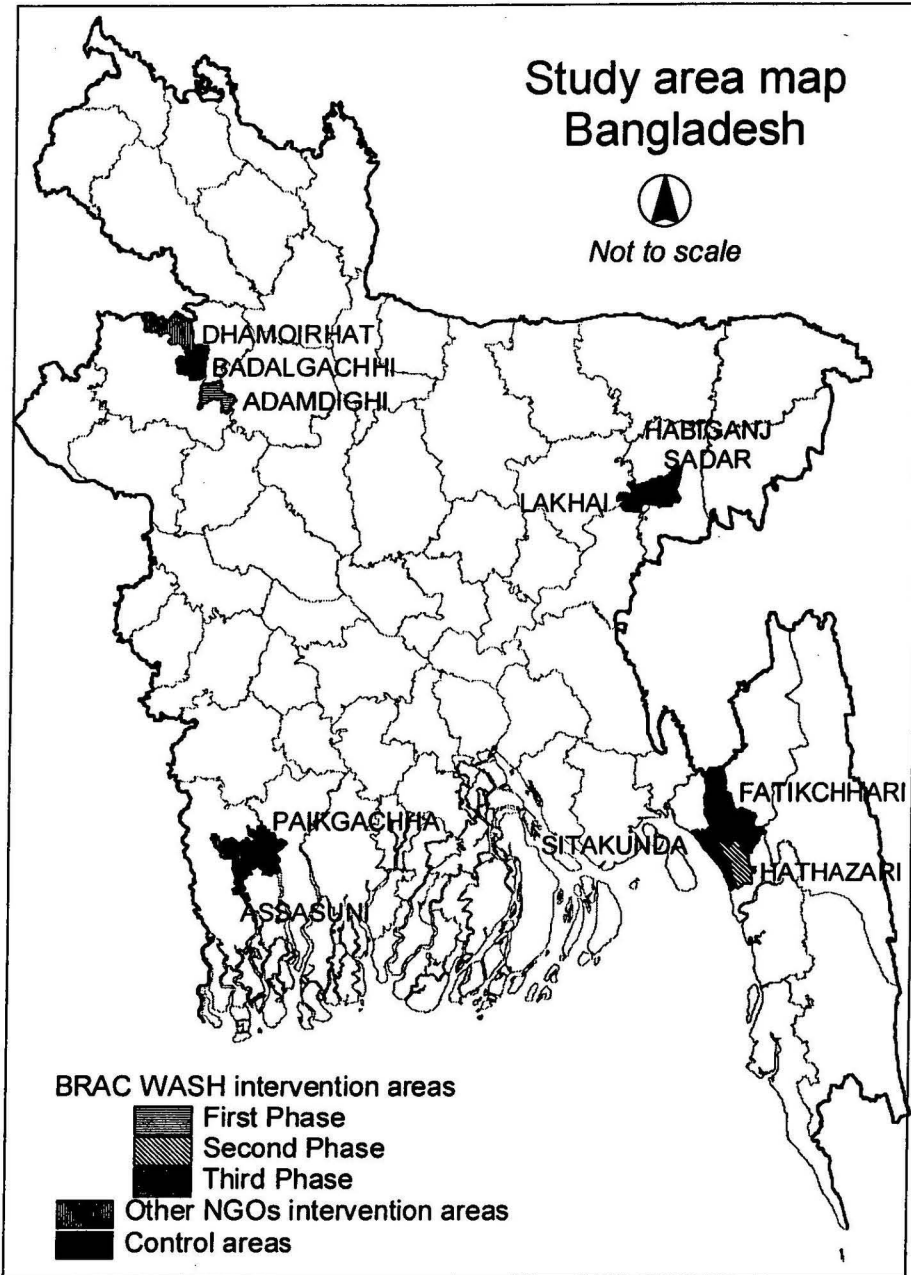
This is a cross-sectional comparative study between areas "with" and "without" NGO-led WASH programme intervention.

STUDY AREAS

The study was carried out in 10 purposively selected *upazilas* (three from BRAC WASH intervention, three from other NGO intervention and four from without any NGO intervention i.e. comparison areas). The comparison areas without any NGO-led WASH activity were adjacent to the areas with programme intervention (Fig. 1).

BRAC WASH is intervening in 150 *upazilas* with both software and hardware interventions of water, sanitation and hygiene components (WASH RESEARCH TEAM 2008). Hence, the areas where the programme was implemented in the first phase had longer duration than those where it was implemented in the second and third phases. Among the three BRAC WASH intervention areas in this study the programme was implemented in three different phases e.g. in the year 2006, 2007 and 2008.

Figure 1. The selected *upazilas* for the study



Under its water component BRAC WASH programme, in terms of hardware intervention, is working on deep well and platform construction, deep set pump construction (in the areas where ground water level is very low), loan support to install tubewell and construct tubewell platform, tubewell installation under school sanitation programme, testing water quality (only those are installed under the programme) in the 35 arsenic contaminated areas and piped water supply, sono-filter, arsenic removal filters, and pond sand filter installation (for saline water areas) in some selected areas of the country. In terms of software intervention the programme is mainly dealing with

the awareness raising, advocacy campaign and community capacity building that include informing about the development of a water safety plan (source, transport, water preservation and consumption), safe distance between tubewell and latrine by the programme organizers (directly from the programme) and with the support of village WASH committee members, union WATSAN committee members, religious leaders (like clergies during Friday congregation), school student brigades, etc. at the community level.

Under hygiene component, BRAC is mainly promoting hygiene activities based on socio-economic and hydro-geological conditions, culture and existing practices. It is being done through hand-washing with soap (especially in critical times), hygiene education and promotion in schools and households, informing people as well as community motivation about improved hygiene behaviour, menstrual hygiene (especially for the adolescent girls), maintaining hygienic latrines, solid waste management (at school and household level) with the help of teachers and village WASH committee members, union WATSAN committee members, religious leaders (clergies during Friday congregation) and school student brigades. Training, rallies, workshops, meetings, women conventions, popular theatres and other advocacy workshops are done in this regard. The target and achievements of BRAC WASH programme have been mentioned in Table 1.

The poverty level of households e.g., hardcore poor, poor and non-poor, was used as criteria for delivering hardware support by the NGOs. Hence, in this study the hardcore poor households were those who owned less than 10 decimals of land, sporadic occupation, and women or physically disable household head. The poor households had fixed source of income and total land ownership was less than 100 decimals. While the non-poor households owned more than 100 decimals of land and had fixed source of income (WASH RESEARCH TEAM 2008).

Table 1. The target and achievements of BRAC WASH programme activities related to safe water and hygiene promotion as of June 2010

Activity	Programme target in no.	Programme achievement in no.
Safe water		
Drilling of deep tubewell (BRAC WASH)	3000	2,821
Loan support to construct tubewell platform	Based on demand	32,466
Upgrade/repair shallow tubewell	Based on demand	4,031
Repairing tubewell platform by motivation	Based on demand	9,902
Establishment of piped water supply system	6	4
Arsenic removal filter	Based on demand	202
Water treatment plant	Based on demand	1
Installation of pond sand filter	Based on demand	222
Hygiene promotion		
Training/orientation of clergies	Based on demand	18,552
Formation of Village WASH Committee	39562	39562
Leadership training for VWC members	79124	79124
Training of Rural Sanitation Center (RSC)	Based on demand	4608

Table 2 summarizes the WASH programme protocol of all the NGOs under this study. Apart from BRAC, the name of other NGOs found in the study areas involved in WASH programme has been kept anonymous. In Assasuni *upazila* of Khulna district three NGOs (A, B and C) were found implementing WASH activities. The NGO A implemented the WASH programme during 2005-2008 and provided software support

through the formation of a local committee involving teachers, clergies, local leaders, and community people as well as creating awareness about safe water, sanitation and hygiene by arranging training, popular theater, rally, discussion, poster, flip chart, etc. The members of the committee selected the hardcore poor households, schools and markets without having access to safe water and improved sanitation facility for hardware support (setting up deep tubewells, rain water harvest plant, and sanitary latrine) from the NGO. The NGO B was working for a short duration (4 months in 2010) in different villages of Assasuni for giving water, sanitation and hygiene support to the disaster affected people through both hardware and software support. People who never received support from any NGO were selected as beneficiaries of the project and were provided with hardware support for hygienic latrine installation. People were also provided with soap, sanitary napkin, oral saline, water purifying tablet and bleaching powder. Moreover, in the monthly meetings of the organization trained people about the methods of using hygienic latrine, safe water and importance of hygiene practices. In Assasuni *upazila* though three NGOs were found active but there was no village with overlapping NGO-led WASH programme interventions from where data was collected.

NGO C was found to be active with almost same programme design in both Assasuni and Dhamuirhat *upazila* of Naogao district since 2008. The intervention areas were selected using two criteria e.g. economic status and sanitary latrine use rate of the households. The programme aimed to support the hardcore poor and the deprived people who did not have ability to build their own sanitary latrine, with priority given to the children and disable people. The organization formed village committees to disseminate information about SL, safe water and hygiene among people. There was also provision of hardware support for the selected households involved in the WASH programme. Reducing the spread of waterborne diseases was one of the prime objectives of the programme.

Table 2. Summary of NGO-led sanitation programme in the study area

Name of NGO	Name of <i>upazila</i> with sanitation programme	Sanitation programme components	Duration of the programme
BRAC	Adamdighi, Hathazari, Habiganj Sadar	Free hygienic latrine supply for hardcore poor, loan for SL installation, Village WASH committee, training	Adamdighi (since 2006 till to date), Hathazari (since 2007 till to date), Habiganj Sadar (since 2008 till to date)
NGO A	Assasuni	Hardware (drilling of deep tubewells, rain water harvest plant and sanitary latrine) support for the hardcore poor, committee at local level for software support e.g., awareness raising	2005-2008
NGO B	Assasuni	Both hardware and software for the disaster affected people	4 months in 2010
NGO C	Assasuni and Dhamuirhat	Software support by the village committee and hardware support for poor and deprived. Priority was given to the children and disables	Since 2008 till to date
NGO D	Sitakundu	Formation of local committee, loan for hygienic latrine installation	2003-2009
NGO E	Sitakundu	Village WASH committee, hardware support with minimum money	2005-2008

In Sitakundu *upazila* of Chittagong district NGO D and NGO E implemented the WASH programme during 2003-2009 and 2005-2008, respectively. NGO D selected the hardcore poor and poor people as beneficiaries of the programme. The organization formed small groups at local level with the involvement of general people to sensitize the community about safe water, sanitation and hygiene through meetings and poster exhibition/video show. There was also provision of giving loans to the people to buy hygienic latrines. The NGO E selected intervention areas where there was worse safe water use, sanitation and hygiene situation requiring efforts for improvement. The target groups were the hardcore poor, landless households with minimum income and with no sanitary latrine. The 10-member village WASH committee in the meetings discussed about the safe water, sanitation and hygiene to raise awareness. People were provided with hardware support for a minimum amount of money, which was used for other programme activities.

SAMPLE SIZE

Representative households for each *upazila* were calculated from the total number of households of the respective *upazila* with 5% admissible error. Thus, the sample size estimated for the survey was approximately 384 for each *upazila*. This was increased to 420 for overcoming non-participation of respondents.

SAMPLING PROCEDURE

The households were selected randomly from the villages of the *upazilas* through the multi-stage 30-cluster sampling technique followed by 14 households from each of the 30 villages. The major variables for quantitative survey were use of tubewell water for different purposes, other sources of water, use of water from other sources, and the reason for using such water, ownership of tubewells used by the households, source of money for tubewell installation, reason for having own source of water, arsenic test status of tubewells, knowledge about the demerits of using arsenic contaminated water and the source of this information, condition of tubewell platform, factors related to the role of NGOs in safe water use by the households, kind of NGO assistance needed, etc. Knowledge about hand washing at critical times, hygiene practices among households, the role of NGOs in improving hygiene practices, source of relevant information, etc. were the key variables for data collection on hygiene practices.

DATA COLLECTION TOOLS AND TECHNIQUES

Both qualitative and quantitative methods were adopted for data collection. Focus group discussions (FGD) were used for qualitative study, while questionnaire was used for quantitative data collection. The respondents of the questionnaire survey were above 18 years old female members, since they were expected to know better the water use and hygiene practices of the households. A FGD of female respondents was conducted in one village from every *upazila* where quantitative data were collected in every *upazila* of the study area. The groups were consisted of minimum 8 persons with the characteristics of having tubewell, not having tubewell, hardcore poor, member of village WASH committee, got tubewell from the NGO, etc. Thus, 10 FGDs were arranged to collect necessary information. For conducting FGD a group of two research assistants were engaged – one of them worked as facilitator and the other took notes. The issues discussed in the FGDs were the sources of water for household use, knowledge about the demerits of using arsenic contaminated water, knowledge about hygiene practices, sources of information about the necessity of using arsenic-free safe water and hygiene practices, the role of NGOs in improving

safe water use and hygiene practices, expected assistance from NGOs to ensure 100% safe water use and hygiene practices. Data collected in the field were cleaned by the research assistants on the same day the FGD was undertaken and noted clearly for English translation.

For the quantitative data collection a set questionnaire was used, which was pre-tested in the field and duly corrected before collecting data from the study areas. The enumerators were divided into groups, with four members in each group to work in each *upazila*. Enumerators were instructed to complete all the questionnaires in the field and cross-check each other's questionnaires before finalizing the daily work. The field managers checked the quality of each interviewer by randomly picking 12 completed questionnaires of a particular day and visited the field to verify answers of some previously selected questions. They were provided with a structured checklist and reported back to the head office with their findings.

The responsibility of the field coordinator was to supervise overall field activities. Field coordinator was the contact person for the WASH research team and would document all the enquiries from the field for immediate dissemination to the concerned researchers. The field coordinator also kept a log book of field activities.

Besides, a team of the core researchers monitored the field activities closely by visiting some selected field locations to ensure the correct way of sampling and data collection and minimize the problems arose in the field.

DATA ANALYSIS

The quantitative data were edited and coded for computer entry. Data thus entered were cleaned and analyzed using SPSS (Version 11.5). The qualitative data were used for supplementing the findings from quantitative data analysis. The FGD notes taken in the field was translated into English by the lead researcher. Each FGD was considered as a unit for summing up the findings. Analysis of data was done based on the consensus of the FGDs on a particular issue of safe water use and hygiene practices. The findings were supplemented with those of the quantitative study.

RESULTS

QUANTITATIVE STUDY

Socioeconomic profile

Literacy, poverty and mass media exposure of the respondents' households selected from three different groups varied significantly ($p < 0.001$), while the household size did not have any significant difference. Though the frequency of poverty in the comparison areas was relatively less than the NGO-led WASH intervention areas, there was lower literacy rate and people had less access to media (Table 3).

Table 3. Key socioeconomic profile of households in the study area

Key characteristics of the respondents' households	WASH programme intervention			All
	BRAC	Other NGO	Comparison	
Average household size	4.9	4.6	4.9	4.8
Percent literacy of household head	70.2	75.3	65.7	69.8
Percent poverty of household	68.6	54.8	51.5	57.6
Percent exposed to media (members >10 years age)	73.5	67.6	50.5	62.5
n	1,260	1,260	1,680	4,200

Safe water use

Tubewell water was used for drinking, cooking, bathing, washing utensils, and cleaning after defecation in the study areas (Table 4). However, significantly higher proportion of households in the BRAC WASH areas used tubewell water for drinking and cooking than the comparison and other NGO intervention areas ($p < 0.001$). Significantly higher proportion of households did not use tubewell water in the other NGO areas ($p < 0.01$) than comparison and BRAC WASH intervention areas ($p < 0.001$).

Table 4. Households using tubewell water for different purposes (%), (multiple responses)

Purposes	WASH programme intervention			p-value		
	BRAC	Other NGO	Comparison	BRAC Vs Other NGO	BRAC Vs Comparison	Other NGO Vs Comparison
Drinking	99.9	93.8	94.4	<0.001	<0.001	>0.05
Cooking	94.8	66.8	84.0	<0.001	<0.001	<0.001
Bathing	63.6	43.8	50.5	<0.001	<0.001	<0.001
Washing utensils	70.7	49.0	74.0	<0.001	<0.05	<0.001
Cleaning after defecation	70.2	43.2	69.8	<0.001	>0.05	<0.001
Do not use tubewell	0.1	5.2	3.2	<0.001	<0.001	<0.01
n	1260	1260	1680			

Water from open sources such as rivers, ponds or ditches were the major alternatives to tubewell water used for different purposes by household, as mentioned by the respondents. It was predominant for bathing, washing utensils, cleaning after defecation and cooking in the

study areas (Table 5). Use of water from other sources was significantly higher in other NGO areas than the BRAC WASH intervention and comparison areas. Significantly higher number of households in other NGO intervention areas than the comparison and BRAC WASH areas used water from other sources for cooking, while higher number of households in the comparison and other NGO areas than the BRAC WASH areas used such water for drinking (Table 5).

Table 5. Indicators relevant to other sources of water for household uses (%)

Indicators	WASH programme intervention			p-value		
	BRAC	Other NGO	Comparison	BRAC Vs Other NGO	BRAC Vs Comparison	Other NGO Vs Comparison
Other sources of water for household uses*						
Supply/tape water	1.2	2.6	1.0	<0.05	>0.05	<0.01
River/pond/ditch/well	56.5	66.5	58.9	<0.001	>0.05	<0.001
Rain water	0.0	0.9	4.3	<0.01	<0.001	<0.001
Do not use other source	41.3	29.9	38.9	<0.001	>0.05	<0.001
n	1260	1260	1680			
Household uses of water from other sources*						
Drinking	0.7	10.7	11.3	<0.001	<0.001	>0.05
Cooking	9.7	54.4	30.6	<0.001	<0.001	<0.001
Bathing	87.7	90.3	94.4	>0.05	<0.001	<0.01
Washing utensils	62.4	77.9	70.2	<0.001	<0.01	<0.001
Cleaning after defecation	41.2	65.5	68.0	<0.001	<0.001	>0.05
Do not use other source	0.1	0.5	0.1	>0.05	>0.05	>0.05
n	740	883	1026			
Reasons for using other sources of water*						
Convenience	56.1	41.2	36.1	<0.001	<0.001	<0.05
No alternatives	40.1	38.7	47.9	>0.05	<0.01	<0.001
Close proximity	4.2	31.0	17.7	<0.001	<0.001	<0.001
Reliability	9.5	8.8	9.2	>0.05	>0.05	>0.05
Presence of iron	1.1	11.4	7.1	<0.001	<0.001	<0.01
n	740	883	1,026			

* Multiple responses were considered

Households in the BRAC WASH intervention areas used significantly higher number of self owned tubewells than the other NGO ($p<0.05$) and comparison areas ($p<0.001$). Households sharing the tubewells were higher in the comparison areas than other NGO and BRAC WASH intervention areas. The expenditure for tubewell installation came predominantly from the self arrangement in all the three categories of intervention areas. The owners received money for tubewell installation significantly higher in BRAC and other NGO intervention areas than the comparison areas ($p<0.05$), however, there was no significant difference between BRAC WASH and other NGO areas in this regard (Table 6).

Table 6. Indicators relevant to the ownership of tubewells being used by the households (%)

Indicators	WASH programme intervention			P-value		
	BRAC	Other NGO	Comparison	BRAC Vs Other NGO	BRAC Vs Comparison	Other NGO Vs Comparison
Ownership of tubewell*						
Self owned facility	50.0	45.5	41.0	<0.05	<0.001	<0.05
Shared facility	50.2	55.9	60.1			
n	1259	1194	1625			
Source of money*						
Self	93.5	93.5	97.9	>0.05	<0.001	<0.001
Neighbor	5.3	3.2	1.6	<0.01	<0.01	>0.05
Local government (Union parishad)	0.4	1.3	0.0	>0.05	>0.05	<0.01
Loan	0.9	0.3	0.2	>0.05	>0.05	>0.05
Free of cost	1.9	0.8	1.0	>0.05	>0.05	>0.05
NGO	1.2	1.1	0.2	>0.05	<0.05	<0.05
Do not know	0.0	0.3	0.0	>0.05	-	>0.05
n	781	711	868			

* Multiple responses were considered

Regardless of the NGO-led WASH programme existence, the respondents not having their own tubewells mentioned financial problem as the predominant reason for their inability to install tubewells. There was no significant ($p>0.05$) difference in the reasons for not having own source of safe water reported by the respondents (Table 7).

Table 7. Reason for not having own source of water in households (%)

Reasons mentioned by the respondents	WASH programme intervention			p-value		
	BRAC	Other NGO	Comparison	BRAC Vs Other NGO	BRAC Vs Comparison	Other NGO Vs Comparison
Financial problem	90.4	91.4	90.5	>0.05	>0.05	>0.05
Lack of land	3.3	3.3	1.7	>0.05	>0.05	>0.05
Joint family	2.5	2.0	2.1	>0.05	>0.05	>0.05
Others	4.0	3.5	5.8	>0.05	>0.05	>0.05
n	479	549	812			

* Multiple responses were considered

Knowledge about the demerits of using arsenic contaminated water in the comparison areas was less than the BRAC and other NGO-led WASH intervention areas, since higher proportion of respondents in the comparison areas reported not to know about the matter than other NGO and BRAC WASH areas. Significantly less number of respondents in the other NGO areas mentioned not to know about the demerits of using arsenic contaminated water than the BRAC WASH areas ($p<0.01$). Regardless of the existence of NGO facilitated WASH programme, social institutions, e.g., family, relatives, neighbours, and educational institutes were the most common information source to households for knowing about the demerits of using arsenic contaminated water. However, compared to the comparison areas the respondents of BRAC WASH and other NGO intervention areas reported significantly higher

contribution of NGO (39.4% and 37.2%, respectively) and mass media (34.6% and 32.9%, respectively) as the sources of relevant information (Table 8).

Table 8. Respondents by knowledge and information source of demerits of using arsenic contaminated water (%)

Knowledge status and information source	WASH programme intervention			p-value		
	BRAC	Other NGO	Comparison	BRAC Vs Other NGO	BRAC Vs Comparison	Other NGO Vs Comparison
Knowledge about demerits of using arsenic contaminated water*						
Skin disease	62.3	69.1	43.3	<0.001	<0.001	<0.001
Gangrene	6.7	2.9	1.2	<0.001	<0.001	<0.01
Cancer	3.6	1.6	1.7	<0.01	<0.01	>0.05
Do not know	36.0	29.5	55.8	<0.01	<0.001	<0.001
n	1260	1260	1680			
Source of information regarding the demerits of using arsenic contaminated water*						
Social institutions	54.4	54.5	53.3	>0.05	>0.05	>0.05
NGO	39.4	37.2	1.3	>0.05	<0.001	<0.001
Local government (Union parishad)	2.4	9.4	4.8	<0.001	<0.01	<0.001
Mass media	34.6	32.9	15.8	>0.05	<0.001	<0.001
n	1,260	1,260	1,680			

The proportion of concrete-constructed tubewell platforms was significantly higher in the BRAC WASH intervention areas (70.9%) compared to other NGO (60.4%) and comparison areas (64.7%). Furthermore, in the BRAC WASH intervention areas significantly ($p<0.001$) higher proportion of tubewell platforms were found clean (61.9%) than the comparison and other NGO intervention (51.8%) and comparison areas (50.9%, Table 9).

Table 9. Status of tubewell platform (%)

Indicators	WASH programme intervention			p-value		
	BRAC	Other NGO	Comparison	BRAC Vs Other NGO	BRAC Vs Comparison	Other NGO Vs Comparison
Tubewell platform						
Made of concrete	70.9	60.4	64.7			
Broken	3.4	9.2	2.2	<0.001	<0.01	<0.001
No platform/not concrete	25.8	30.5	33.1			
n	776	699	865			
Clean tubewell platform	61.9	51.8	50.9	<0.001	<0.001	<0.05
n	775	699	865			

The odds ratio of selected variables predicting the reasons of not having own tubewell in the households reveals that the households in the comparison areas (OR 1.7, CI 1.4-1.9) as well as in other NGO intervention areas (OR 1.5, CI 1.2-1.7) had more tendency of not having

own tubewell compared to those in the BRAC WASH areas (Table 9). When all other variables are controlled, household heads who were illiterate (OR 1.6, CI 1.3-1.8) or educated up to primary level (OR 1.5, CI 1.3-1.8) show more likelihood of not having own tubewell. Considering the household poverty level as a variable influencing the tendency of not having own tubewell, hardcore poor (OR 2.3, CI 1.9-2.7) and poor (OR 1.7, CI 1.5-2.0) households show significantly higher association than the non poor households. In addition, households which were landless (OR 1.8, CI 1.4-2.4) or did not have access to media (OR 1.4, CI 1.2-1.6) were more likely to not having own tubewells (Table 10).

Table 10. Odds ratio of selected variables predicting the issues of not having own tubewell

Predicted variables	OR	95% CI	p Value
Intervention			
BRAC WASH	1		
Other NGO	1.5	1.2 – 1.7	< 0.001
Comparison	1.7	1.4 – 1.9	< 0.001
Education of household head			
Class v+	1		
Class i-v	1.5	1.3 – 1.8	< 0.001
Illiterate	1.6	1.3 – 1.8	< 0.001
Poverty			
Non poor	1		
Poor	1.7	1.5 – 2.0	< 0.001
Hardcore poor	2.3	1.9 – 2.7	< 0.001
Land ownership			
Landowner	1		
Landless	1.8	1.4 – 2.4	< 0.001
Media			
Access	1		
Non Access	1.4	1.2 – 1.6	< 0.001

The respondents reported minor cases of offering assistance from NGOs for installing tubewell. There was significantly ($p < 0.001$) higher offer for assistance from the NGOs to install tubewells in the WASH programme intervention areas, either BRAC or other NGO areas, than the comparison areas (Table 11). Motivation for installing tubewell or using tubewell water was the predominant NGO assistance reported by the respondents in the NGO intervention areas (BRAC 34.4%, other NGO 28.2%), which was found minimum in the comparison areas (0.9%).

Table 11. The issues relevant to NGO role in safe water use reported by the respondents (%)

Indicators	WASH programme intervention			p-value		
	BRAC	Other NGO	Comparison	BRAC Vs Other NGO	BRAC Vs Comparison	Other NGO Vs Comparison
NGO offer for assistance in drilling tubewell						
Yes	3.3	3.1	0.1			
No	95.8	95.9	0.8	>0.05	<0.001	<0.001
No NGO activity	0.1	0.3	98.7			
Don't know	0.8	0.7	0.4			
n	781	711	868			
Kind of NGO assistance*						
Motivation	34.4	28.2	0.9	<0.01	<0.001	<0.001
Tubewell at free of cost	0.7	1.7	0.1	<0.05	<0.01	<0.001
Arsenic testing	1.8	10.5	0.5	<0.001	<0.001	<0.001
No assistance	64.2	63.5	98.6	>0.05	<0.001	<0.001
n	1260	1260	1680			
Impact of NGO assistance in using safe water*						
Increased	90.1	55.3	0.4			
No change	6.5	31.0	0.6	<0.001	<0.001	<0.001
Decreased	0.6	3.7	0.1			
No NGO activities	2.8	9.9	98.9			
n	1260	1260	1680			
Necessity of NGO intervention						
Yes	98.2	97.7	90.9	>0.05	<0.001	<0.001
n	1260	1260	1680			
Expected duration of NGO intervention						
Less than 1 year	4.4	4.3	37.7			
1 to 5 years	20.8	44.2	33.5	<0.001	<0.001	<0.001
More than 5 years	74.9	51.5	28.8			
n	1237	1231	1527			

* Multiple responses were considered.

Furthermore, installing tubewell free of cost was also found significantly ($p < 0.05$) higher in other NGO intervention areas than the BRAC WASH programme areas (BRAC 0.7% and other NGO 1.7%). In addition, assistance for arsenic testing was significantly higher in other NGO intervention areas (10.5%) than the BRAC and comparison areas. Respondents in the BRAC WASH intervention areas (90.1%) opined significantly ($p < 0.001$) higher for the increase of safe water use due to assistance from BRAC than other NGO (55.3%) and comparison areas (0.4%). Irrespective of the WASH programme existence, 95.1% of the respondents thought NGO assistance necessary for safe water use in the households. Majority of them in the NGO intervention areas (BRAC 74.9%, other NGO 51.5%) argued for more than 5 years long programme necessary for ensuring 100% safe water use by the households. Both in the NGO-led WASH programme (BRAC or other NGO) and comparison areas the respondents not having their own tubewell reported predominantly for necessity of tubewells supplied by the NGOs rather than financial assistance (Table 12).

Table 12. Respondents reported the types of NGO assistance needed (%)

Indicators	WASH programme intervention			p-value		
	BRAC	Other NGO	Comparison	BRAC Vs Other NGO	BRAC Vs Comparison	Other NGO Vs Comparison
Financial assistance	4.6	6.0	6.2	>0.05	>0.05	>0.05
Tubewell	95.4	94.0	93.8			
n	455	531	779			

Hygiene practices

The knowledge about hand washing with soap during critical times showed that significantly ($p < 0.001$) higher proportion of respondents in other NGO intervention areas mentioned to wash hands at most of the critical times, i.e., before eating, after defecation, after cleaning the bottom of babies, before feeding babies, after eating and before serving food than the BRAC WASH intervention and comparison areas. But, between BRAC WASH and other NGO intervention areas there was no significant difference in knowledge of washing hands before feeding babies and before cooking. Nevertheless, the knowledge of washing hands in BRAC WASH intervention areas was significantly higher than the comparison areas, except that of after defecation ($p > 0.05$, Table 13).

Table 13. Knowledge on hand washing at critical times

Hand washing at critical times	WASH programme intervention			p-value		
	BRAC	Other NGO	Comparison	BRAC Vs Other NGO	BRAC Vs Comparison	Other NGO Vs Comparison
Before eating	92.6	96.8	69.4	<0.001	<0.001	<0.001
After defecation	94.8	98.0	95.8	<0.001	>0.05	<0.01
After cleaning bottom of babies	10.1	16.4	15.1	<0.001	<0.001	>0.05
After cleaning house premise	33.3	52.1	48.8	<0.001	<0.001	>0.05
Before feeding babies	9.1	11.2	3.4	>0.05	<0.001	<0.001
Before cooking	33.5	31.0	11.0	>0.05	<0.001	<0.001
After eating	38.3	45.6	31.9	<0.001	<0.001	<0.001
Before serving food	9.3	22.5	5.5	<0.001	<0.001	<0.001
n	1260	1260	1680			

Compared to other NGO intervention areas, higher proportion of respondents in BRAC WASH intervention areas mentioned that they did not know about the hygiene knowledge indicators. All the indicators for hygiene practices, except how water get polluted at household and rules for using sanitary latrine reported by the respondents in BRAC WASH intervention areas were found significantly higher than the comparison areas. However, in other NGO intervention areas significantly less proportion of respondents mentioned not to know about the indicators of hygiene practices than the comparison areas (Table 14).

Table 14. Knowledge about hygiene practice among households (%)

Indicators	WASH programme intervention			p-value		
	BRAC	Other NGO	Comparison	BRAC Vs Other NGO	BRAC Vs Comparison	Other NGO Vs Comparison
How water gets polluted at household*						
Contact with dirty hands	39.0	22.9	17.3	<0.001	<0.001	<0.001
When waste falls into water	67.5	78.3	72.7	<0.001	<0.01	<0.01
Container is kept uncovered	35.2	47.5	28.8	<0.001	<0.001	<0.001
Don't know	10.6	0.8	9.5	<0.001	>0.05	<0.001
Types of diseases caused by contaminated water*						
Diarrhoea	89.7	97.3	87.6	<0.001	>0.05	<0.001
Dysentery	38.3	38.9	23.3	>0.05	<0.001	<0.001
Skin disease	13.5	17.1	15.5	<0.05	>0.05	>0.05
Jaundice	10.8	6.7	5.8	<0.001	<0.001	>0.05
Cholera	27.9	33.0	20.7	<0.01	<0.001	<0.001
Arsenicosis	1.3	0.6	0.0	<0.01	<0.001	<0.01
Don't know	7.9	2.1	10.4	<0.001	<0.05	<0.001
How water can be purified*						
By boiling	72.9	81.2	58.8	<0.001	<0.001	<0.001
With medicine	31.9	45.0	19.9	<0.001	<0.001	<0.001
By filtering	4.5	11.3	13.5	<0.001	<0.001	>0.05
Don't know	16.8	6.4	22.7	<0.001	<0.001	<0.001
How water borne diseases can be prevented*						
Drinking safe water	56.0	79.4	30.1	<0.001	<0.001	<0.001
Keep cleanliness	32.1	28.1	41.0	<0.05	<0.001	<0.001
Don't know	24.0	11.8	37.3	<0.001	<0.001	<0.001
Rules of using latrine*						
Wear sandal	80.7	89.7	67.6	<0.001	<0.001	<0.001
Take water pot with right hand	27.4	4.4	5.1	<0.001	<0.001	>0.05
Wash hands with soap after defecation	80.2	91.8	87.1	<0.001	<0.001	<0.001
Members from all ages in HH should use sanitary latrine	13.3	5.1	1.8	<0.001	<0.001	<0.001
Clean the latrine every time	16.7	23.1	18.9	<0.001	>0.05	<0.01
Don't know	2.1	0.8	2.3	<0.01	>0.05	<0.01
Types of diseases attack if sanitary latrine in not used						
Stomach disorder	84.1	92.0	59.4	<0.001	<0.001	<0.001
Worm Infestation	14.1	20.0	14.6	<0.001	>0.05	<0.001
Don't know	12.8	4.4	35.1	<0.001	<0.001	<0.001
n	1,260	1,260	1,680			

(*Multiple responses were considered)

Significantly higher ($p < 0.001$) proportion of the respondents reported that the knowledge of people about hygiene increased due to intervention in the BRAC WASH areas (89.9%) than the other NGO areas (63.1%). Most respondents from all intervention areas strongly felt (95.8%) for the necessity of NGO-led WASH programmes for improvement of hygiene practices. More respondents in the BRAC WASH intervention areas (74.2%) and other NGO intervention areas (53.0%) argued

that more than 5 years of programme intervention might be necessary, while in the comparison areas majority (37%) asked for less than 1 year of programme intervention for attaining 100% hygiene practices in the households. While asked about the source of information regarding hygiene practices, social institution (54.8%) and mass media (24%) were found predominant among all intervention areas. However, in areas with NGO-led WASH programme intervention, either BRAC (32.1%) or other NGO (23.9%), respondents also mentioned NGOs as information source for hygiene practices (Table 15).

Table 15. The issues relevant to NGO role in hygiene reported by the respondents (%)

Indicators	WASH programme intervention			p-value		
	BRAC	Other NGO	Comparison	BRAC Vs Other NGO	BRAC Vs Comparison	Other NGO Vs Comparison
Impact of NGO assistance on the hygiene awareness						
Increased	89.9	63.1	0.5			
Decreased	1.2	4.9	0.1	<0.001	<0.001	<0.001
No change	5.6	24.6	0.4			
No NGO activity	3.3	7.4	99.1			
n	1260	1260	1680			
Necessity of NGO intervention						
Yes	99.1	98.0	91.7	<0.05	<0.001	<0.001
n	1260	1260	1680			
Expected duration of NGO intervention						
Less than 1 year	6.7	4.5	37.0			
1 to 5 years	19.1	42.5	33.4	<0.001	<0.001	<0.001
More than 5 years	74.2	53.0	29.6			
n	1260	1260	1680			
Source of information regarding hand washing at critical times						
Social institutions	40.9	47.8	76.4	<0.001	<0.001	<0.001
NGOs	32.1	23.9	2.5	<0.001	<0.001	<0.001
Union Parishad/local government	1.0	2.8	0.7	<0.001	<0.05	<0.001
Newspaper/TV/radio/poster	26.0	25.4	20.4	>0.05	<0.001	<0.001
Total response	2057	2087	1996			

QUALITATIVE STUDY

Use of safe water

FGDs in both comparison areas and NGO intervention areas reported that people mostly used tubewell and pond water for household chores, while some people who did not have own tubewell, shared others' tubewells. Almost all of the FGD participants thought that tubewell water was safe water. However, few of them opined that arsenic-free tubewell water was safe. FGDs further revealed that people in comparison areas did not know whether tubewells of their locality were arsenic contaminated or not. However, FGDs reported that most of the people of both comparison and NGO intervention areas knew that drinking of arsenic contaminated water might cause skin diseases. People learnt about arsenic contamination from NGO workers, meetings,

newspaper, radio and television. FGD participants believed that the NGO interventions were appropriate to improve the situation of safe water use. They also believed that the situation would be improved more if NGOs would provide them with tubewells free of cost. In a FGD it was commented, *"We cannot provide education to our kids, how can we install tubewells? Give us tubewells free."*

FGDs reported that the situation of safe water use increased compared to previous situation, but still many people were reported to be unaware about the necessity of safe water use. It was mentioned that people in many instances could not afford to establish tubewells. A FGD cited, *"I have my house only. I do not have any latrine. My husband pulls rickshaw to run the family. How I can buy tubewell?"* All the FGDs mentioned that without NGOs the local people would not be able to enhance use of safe water, because majority of the villagers were busy with their own works. Additionally the local people did not have enough money to help others for installing tubewells. However, the FGDs reported that increased participation of general people in improving the situation of safe water might be possible if necessary initiative were taken to raise awareness among people.

Hygiene practices

The FGDs reported that regardless of the existence of NGO-led WASH programme, majority of the people might have knowledge about hygiene practices. The participants of the FGD mostly knew about the waterborne diseases, the rules of using sanitary latrines, hand washing, and the ways of water contamination, etc. However, it was reported that not all of them really practiced the hygiene knowledge and most of the poor households had the tendency not to follow the rules of hygiene practices. The overall hygiene situation in the NGO intervention areas, either BRAC or other NGO, was reported to be better than the comparison areas. FGDs revealed the recognition of NGO activity in hygiene promotion since people came to know about relevant messages from the meetings organized by the local committees formed by the NGO employees. Apart of the NGO meetings, radio, television and newspaper were said to help them knowing about the necessity of hygiene practices. A FGD mentioned, *"From watching the Meena cartoon in the TV we have come to know about the necessity of hygiene practices."*

Nevertheless, FGDs of both comparison and NGO intervention areas reported the necessity of WASH programme activities to make people aware of the hygiene practices as well as make practices in daily life. However, they mentioned poverty and unawareness as reasons for the people not to follow hygiene practices, and NGOs should play a role in this regard. Without the NGOs' assistance it would not be possible to raise awareness involving the local people, since they would not listen to each other. But the NGO employees could impart training on hygiene practices and people would listen to them more. One of the FGD mentioned, *"The NGO can train us about hygiene and also give us free soap."*

DISCUSSIONS

Both in the NGO-led WASH programme intervention areas (either BRAC or other NGO) and in the comparison areas tubewell was the predominant (avg. 95.9%) source of drinking water. The FGDs also reported tubewell water as the safe water source for majority of households. This result substantiates previous research findings reporting 90% of the rural population using tubewell water for drinking (Nahar 1997). However, arsenic prevalence in tubewell water has been reported to be a major challenge in Bangladesh since due to arsenic contamination, safe water access is estimated to have dropped from 97% to 80% nationwide (UNICEF 2000). Higher awareness about arsenic was found in the other NGO-led WASH intervention areas (both BRAC and other NGO) compared to the comparison areas. This might be attributed to the awareness activities implemented by the NGOs regarding safe water use (World Bank 2006). Safe drinking water is achieved by a combination of a protected and high quality source at the initial point and maintaining quality from the initial supply (source) point to final consumption (Hoque *et al.* 2006). Building permanent or concrete tubewell platforms and keeping them clean might reduce the chances of water contamination at the source. One unique feature of BRAC WASH programme is to give loan to the households or motivate them to build concrete tubewell platforms. As part of the programme interventions 32,466 households were provided with loan for building concrete tubewell platforms and 9,902 platforms were repaired by motivation. The impact of such intervention is reflected on the higher incidents of clean and permanent concrete-built tubewell platforms in the BRAC WASH intervention areas compared to the other NGO and comparison areas. Though around 57.6% of the households in the study areas were poor, the tubewells owned by the households were mostly installed with their own money. Poverty, illiteracy, landlessness and lack to access to media were found to be the major challenges for installing of tubewells as source of safe water for households. Similarly, the study of Caldwell *et al.* (2002) showed that although most of the people were under poverty majority of the tubewells were self financed. Respondents of households who did not have their own tubewell reported financial problem as the reason for their inability to install tubewell and they expected free of cost tubewell from NGOs as assistance for ensuring 100% safe water use. The FGD findings were also in agreement with the quantitative results. Nevertheless, compared with comparison areas more NGO supports in terms of loan and free tubewell installation were observed in the NGO-led WASH intervention areas, though it contributed only approximately 1% of the total number of tubewells. Both in quantitative and qualitative study the positive role of NGOs in increasing safe water use was revealed. The FGDs mentioned that without NGO intervention it might not be possible to ensure 100% safe water use with the involvement of local people. The awareness activities and training provided by NGOs might be a strong tool in this regard. Awareness raising activities undertaken by the NGOs potentially supplement the DPHE/UNICEF arsenic mitigation activities since 1996. Bangladesh has set national target of providing 100% arsenic-free drinking water for the population by 2013 (IRIN 2009). However, it requires intensification of NGO activities to reach the national target.

Both in the quantitative and qualitative study it was revealed that due the NGO-led WASH interventions the knowledge on hand washing and hygiene practices increased among people. This might be because of the awareness raising activities of the village WASH committees, which were absent in the comparison areas. In a recent

study it was found that motivational activities like cluster meetings, home visits, popular theatre, and other educational programmes increased awareness among the respondents of BRAC WASH intervention areas (Rana *et al.* 2010). Nevertheless, the study reveals that the NGO assistance is inevitable for ensuring 100% hygiene practices among the people and majority of the respondents felt that several years of NGO intervention might be necessary in this regard. The NGO-led activities involving collateral-free credit services for the poor together with support services for group formation, skill training, adult literacy, health education and legal awareness have contributed towards social well-being. The role of educational intervention and participation in credit programme in changing sanitation behaviour has already been reported (Hadi 2000). Thus, the integrated approach of WASH led by the NGOs is also enhancing the use of safe water and hygiene practices together with improved sanitation.

A major limitation of this study is that the duration of WASH programme implemented by BRAC or other NGOs in the study areas were not same. The BRAC intervention areas for this study were selected from three different phases where the programme had different durations. There might be the impact of programme duration on safe water use and hygiene practices in the intervention areas. This is also true for other NGO intervention areas, i.e. where the programme had been implemented for longer time the overall safe water use and hygiene awareness might be better than the areas where the programme intervention was relatively short. Nevertheless, there were no baseline data collected from the study areas. Only cross sectional data were compared to find the role of NGO interventions in improving the use of safe water and hygiene practices.

CONCLUSION

The NGO-led WASH interventions could improve community awareness on the use of safe water and hygiene practices compared to the comparison areas. People acknowledged the effect of NGO activities in this regard and felt that such activities are necessary for ensuring 100% safe water use and hygiene practices. Thus, the NGO-led WASH interventions need to continue and extend with intensification of support for poor and illiterate communities.

REFERENCES

- Ahmed R (2008). Journey towards changing behavior: Evolution of hygiene education in Bangladesh. *In: Beyond construction: use by all, a collection of case studies from sanitation and hygiene promotion practitioners in South Asia.* Water Aid, London and IRC International Water and Sanitation Center, Delft: 288-301.
- Appleton B and Wijk CV (2003). Hygiene promotion. Thematic overview paper. Delft: IRC International Water and Sanitation Centre.
- Caldwell BK, Caldwell JC, Mitra SN, Smith W (2002). Tube wells and arsenic in Bangladesh: challenging a public health success story. Paper presented at the IUSSP Regional Population Conference on Southeast Asia's Population in a Changing Asian Context, Bangkok, 10-13 June.

- Ghosh SC, Karim F, Ali ARMA, Arif T (2011). The role of NGOs in improving sanitation status in rural areas of Bangladesh: challenges and expectations.
- Hadi A (2000). A practical approach to sanitation: experience of Bangladeshi NGOs. *Health Policy Plann* 15(3):332-7.
- Hadi A and Nath SR (1996). Raising sanitary latrine use in rural Bangladesh: can BRAC play any role? Dhaka: BRAC Watch Report no. 22
- Harvey P, Baghri S, Reed B (2002). Emergency sanitation: assessment and programme design. Water Engineering and Development Center (WEDC). Leicestershire: Loughborough University.
- Hoque BA, Hallman K, Levy J, Bouis H, Ali N, Khan F, Khanam S, Kabir M, Hossain S, Alam MS (2006). Rural drinking water at supply and household levels: quality and management. *Int J Hyg Environ Health* 209(5):451-60.
- IRC (2008). About hygiene promotion, IRC. www.irc.nl/page/6354 (Accessed on 14th September 2010).
- IRIN (2009). Bangladesh: arsenic-free drinking water by 2013? www.irinnews.org/report.aspx?reportid=82697 (accessed on 26th October 2010).
- LGD (2008). Bangladesh country report: Sanitation in Bangladesh. Third South Asian Conference on Sanitation SACOSAN-III. India, Local Government Division (LGD), Ministry of Local Government, Rural Development and Cooperatives, Government of the People's Republic of Bangladesh.
- Milligan O, Njie A, Bennett S (2004). Comparison of two cluster sampling methods for health surveys in developing countries. *Int J Epidemiol* 33:469-76.
- Nahar N (1997). Arsenic: silent catastrophe. *Bul Environ Health* 1:1-4.
- Rana AKMM, Barua MK, Kabir B (2010). Measuring changes in self-reported hand washing practices with soap among women: a community based empirical study in rural Bangladesh. BRAC research report. (unpublished)
- Save the Children (2009). Improving water and sanitation in schools and communities: Successes and lessons learned from Nasirnagar, Bangladesh. Washington, DC: Save the Children.
- UNICEF (1999). A manual on hygiene promotion: towards better programming, Water, Environment and Sanitation Technical Guidelines Series No. 6, United Nations Children's Fund (UNICEF) and the London School of Hygiene and Tropical Medicine (LSHTM), New York., USA. www.unicef.org/wash/files/hman.pdf (Accessed on 14th September 2010).
- UNICEF (2000). Arsenic mitigation in Bangladesh. Dhaka: UNICEF. UNICEF media brief.
- UNICEF (2010). First annual High Level Meeting for Sanitation and Water for All aims to be a watershed for reaching the MDG targets: Adequate sanitation and access to safe water directly impact the health and economic status of families and nations, Washington DC. www.unicef.org/bangladesh/media_6193.html (Accessed on 30th August 2010).
- WAB (2003). Water, sanitation and hygiene promotion: A civil society submission to the Government of Bangladesh, participatory process for the development of the National Strategy for Economic Growth, Poverty Reduction and Social Development, Poverty Reduction Strategy Paper, Water Aid Bangladesh (WAB), Dhaka. www.who.int/water_sanitation_health/hygiene/sanhygpromo.pdf (Accessed on 14th September 2010).

WASH Research Team (2008). WASH Programme of BRAC: towards Attaining the MDG Targets, Baseline Findings. Dhaka: BRAC, 123p.

WHO and UNICEF (2010). Progress on sanitation and drinking-water: 2010 Update. WHO/UNICEF Joint Monitoring Programme for Water Supply and Sanitation. Geneva: WHO Press.

World Bank (2006), Economics and governance of nongovernmental organizations in Bangladesh. Dhaka: The World Bank. www.worldbank.org.bd/bds (Accessed on 4th October 2010), Bangladesh Development Series, Paper No: 11.
www.schoolsandhealth.org/Documents/Bangladesh%20Successes%20and%20lessons%20learned%20from%20Nasirnaga%20Improving%20water%20and%20sanitation%20in%20schools%20and%20communities%20Brief2.pdf. (Accessed on 30th August 2010).