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# The BRAC WASH Programme: Describing the core operational approaches, monitoring, evaluation and some results

*Fazlul Karim, Tahera Akter, Nepal C. Dey and Milan K. Barua, Bangladesh*

## ABSTRACT

This paper describes the major operational approaches of the BRAC WASH programme including monitoring, evaluation and some results. To carry out this study on water safety practices, use of sanitation facilities and self-reported water-related disease prevalence, a comparison was made between baseline (November 2006 to June 2007) and end-line (December 2010-February 2011) surveys done by the BRAC Research and Evaluation Division. The relative changes in indicator values from baseline to end-line were computed to investigate the effects of the programme. The overall proportion of arsenic-free tubewell increased at the endline from the baseline, respectively by 3.1% for the ultra poor, 3.7% for the poor and 2.2% for the non-poor. The proportion of concrete-built tubewell platforms significantly increased from the baseline to the end line for all economic groups, where the ultra poor registered the highest increase by 29.8%. Use of sanitary latrines increased significantly by 81.1% from the baseline (31.7%) to the end line (57.4%). Though ownership of latrines significantly increased at end line for all economic groups, the greatest increase was for the ultra poor (37.3%). The proportion of households replacing latrines or desludging latrine pits filled-in latrines increased from baseline to end line by 33.8%. The overall self-reported prevalence of water-related diseases significantly reduced by 75.5% from baseline to end-line. The findings suggest that a reasonably well-implemented programme is likely to improve safe water and latrine use and may reduce water-related diseases prevalence.

## INTRODUCTION

Risk to water safety systems due to point and nonpoint sources of pollutants is a vital concern. People in Bangladesh have limited understanding about the issues and linkage between poor hygiene and diseases, resulting in high morbidity and mortality. Besides, effective behaviour change in different aspects of water, sanitation and hygiene is also a grave concern for improved health status. However, to combat the problems, BRAC, in cooperation with the government, initiated the water, sanitation and hygiene (WASH) programme in 2006 in 150 low performing *upazilas*.

## THE BRAC WASH PROGRAMME

### Goal

To facilitate the attainment of the water, sanitation and hygiene-related MDGs, with a special focus on the rural underprivileged groups. The programme with financial support from the Netherlands Government targeted to ensure sanitation service to 17.6 million people, hygiene education to 38.8 million people and safe water to 8.5 million people in 150 intervention sub-districts (*upazilas)* **(BRAC 2011).**

### The core operational approaches

The programme adopted innovative approaches to empower people towards installing, using and maintenance of safe water sources, sanitation facilities, and practice of personal and water and sanitation hygiene. The programme implemented a package of innovative integrated activities through innovative approaches as follows.

(1) Formation of Village level WASH Committee (VWC): Formation and fostering of a VWC in each village with 11 members (5 males and 6 females) taking representatives from all stakeholders. A VWC was a bridge between BRAC and community. The VWC members were entrusted with the following specific tasks: a) selection of sites for community water sources, collection of money for sharing costs, activity monitoring and latrine maintenance; b) identification of ultra poor for BRAC or government grants; and c) identification of poor households willing to take micro-credit for installing sanitary latrines or constructing tubewell platforms.

(2) Capacity building of different stakeholders:
   (a) BRAC WASH staff— All staff underwent basic training on conceptual issues of the programme, its implementation procedures including planning and management of field activities. Some senior managers attended international courses on WASH management.

   (b) Other staff of BRAC— A series of orientation sessions for other staff of BRAC were organized in all the sub-districts under WASH programme to raise their awareness about WASH activities and to link into other BRAC programme networks, so that staff in other programmes could easily become involved in WASH programme operations. This is meant to help sustain the WASH activities even after withdrawal of WASH programme.

   (c) Local government and NGO personnel— To strengthen networking and involvement of different stakeholders at grassroots, orientation sessions were organized for the representatives of union council chairmen and members, opinion leaders, teachers or school management committees and local NGO staff. Thus, BRAC sought their cooperation in implementing WASH activities.

(3) The diffusion approach— BRAC's software approach was to inform all stakeholders to improve their sanitation and hygiene status through advocacy and orientation to WASH approach. It was a blanket approach where a common set of WASH messages were being delivered through a diverse number of mutually reinforcing channels like cluster meetings; popular drama; school WASH especially for girls; imam WASH conventions; posters; and small private sector WASH providers (*shasthya shebikas*, artisans and sweepers) promoting WASH products **(Choudhury *et al*. 2008).**

(4) School sanitation and hygiene education— Sanitation facilities in rural schools were either poor or non-existent, posing problem especially to girls, resulting in absenteeism or dropout. The programme worked with the secondary school authorities and provided separate latrines with adequate water and waste disposal facilities for girls. For better management and maintenance of the facilities, school student brigades and School WASH Committees began to work in 4,000 secondary schools.

## PROGRAMME COMPONENT-SPECIFIC APPROACH

(a) Water—BRAC implemented development of a water safety plan, installation of deep tubewells, water quality tests and provision of loans for constructing tubewell platform. In arsenic and saline affected areas, the programme installed deep tubewells, constructed pond sand filters and arsenic removal filters and small piped water supply systems to provide safe water. About 3,256 deep tubewells were sunk in arsenic affected areas, whilst 4 rural piped water systems were made functional.
(b) Sanitation— Apart from demand creation for sanitary latrines and the revival of existing rural sanitation centres (RSC), new ones were set up for increasing access of the remote communities to toilet parts. Interest-free loans were given to local entrepreneurs to produce quality latrine parts, followed by training in production technology. Households unable to afford full costs for procuring sanitary latrines were supported with loans, while the ultra poor households were given materials for two-pit latrine construction, including mini water tanks free of cost. Over 5.2 million sanitary latrines were installed to cover 25.2 million people.
(c) Hygiene—The programme delivered hygiene messages that were based on socioeconomic and hydro-geological conditions, culture and existing practices of the people, using various channels and involving opinion leaders including religious leaders.

## APPROACH TO PROGRAMME QUALITY CONTROL

Continuous monitoring and evaluation by different stakeholders was employed for quality control of the programme as delineated below.

(a) Monitoring— A two-tier mechanism was in place to monitor the quality of the programme: (1) The programme itself maintained an in-built monitoring mechanism to collate, and analyse input-output data for immediate feedback to management; and (2) BRAC independent monitoring department conducted issue-based routine monitoring on different activities of the programme and provided feedback for management functions.

(b) Research and evaluation—The independent Research and Evaluation Division (RED) of BRAC conducted periodic studies. Thus, the staff got continuous feedback for quality control. RED also conducted a baseline survey (BL) to understand the pre-programme status vis-à-vis the impact evaluation of the programme overtime. Subsequently, a midline survey (ML; April to July 2009) was done two years after the baseline (BL; November 2006 to June 2007) to assess the project effects for various indicators of water, sanitation and hygiene at community level. This was followed by an end line survey (EL; December 2010 to February 2011) at the end of programme. In this paper, we used the RED's baseline and end line survey data to reflect the comparative effects of the combined approaches of programme in water safety, sanitation and self-reported water-related diseases prevalence.

**Objective/s**

This study assessed the effects of the BRAC WASH programme in water use and safety systems, sanitation coverage and self-reported prevalence of water-related diseases under the programme areas compared to benchmark status. The specific objectives were to assess and compare:

(i) the effect of WASH interventions on different indicators pertaining to water use and safety systems at households; (ii) the magnitude of changes in safe sanitation coverage and use of facilities in households; and (iii) reduction in the prevalence of water-related diseases.

**Data collection methods and materials**

**Study design and area**

This cross-sectional comparative study between the baseline (BL) and end-line (EL) was implemented in 50 sub-districts where WASH programme of BRAC had been offering its interventions since middle of 2006. These sub-districts are known as low performing areas in terms of water, sanitation and hygiene coverage compared to the national average of the total 150 sub-districts.

**Sample size and sampling procedures**

The sample was comprised of 30,000 households for specific objectives two and three shown below, and 6,600 for objective one in both surveys (Table A). Using the 30-cluster sampling design 600 households were selected from each of the study *upazilas by objectives* in two steps: 30 villages were selected from each *upazila;* and from each village 20 households were selected systematically (Seraj 2008). A total of 29,985 households were interviewed at baseline in 50 *upazilas* while at end line the corresponding figure was 26,404 households, 11.9% were lost at end line survey for various reasons such as unavailability of the respondents, river erosion, etc.

**Data collection**

Trained field interviewers collected data from a competent female member of each household through interview using pre-tested questionnaires. Some verifiable variables such as statuses of tubewell platforms, platform cleanliness, presence of arsenic test mark at tubewell (red or green), presence of hygienic sewerage system around tubewell, presence of soap nearby latrine, bad smelling, water preserved nearby latrine, latrine clean, etc. were physically verified. Regarding illness occurrence, the interviewers asked a question, "Did anybody of your household suffered from any illnesses such as abdominal diseases, worms, jaundice, etc. during the last 15 days? If yes, please specify…" Data were collected during November 2006 to June 2007 at baseline, and during December 2010 to February 2011 at end line.

**Table A. Specific study objectives, number of sub-districts and sample households in each sub-district, and data collection methods**

| Objectives | No. sub-districts | No. households per sub-district | No. matched households | Data collection methods |
|---|---|---|---|---|
| 1. Assess the effect of WASH interventions in different water safety indicators at household level. | 11 | 600 | 528 | Interview |
| 2. Assess the magnitude of changes in safe sanitation coverage and their use at household level. | 50 | 600 | 528 | Interview |
| 3. Assess changes in the self-reported prevalence of water-related diseases in the project areas. | 50 | 600 | 528 | Interview |

**Data management and analysis**
The analysis was performed using the SPSS version 14 on the matched households in both the surveys (26,404 in each). The extent of relative changes between the baseline and the end line was determined using the following formulae: Relative change= End line status minus baseline status/baseline status x100. Chi-square and t-tests compared the differences in indicator values between the surveys.

**Definition of variables**
*Sanitary latrine*: A sanitary latrine included (i) confinement of feces away from the environment, (ii) sealing of the passage between the squat hole and the pit to effectively block the pathways for flies and other insect vectors thereby breaking the cycle of disease transmission, and (iii) keep the latrine odour-free and encourage continual use of the hygienic latrine **(LGD 2005).**
*Water-related diseases*: Diarrhoea, dysentery, jaundice, worm infections, polio, typhoid, and skin diseases were considered as marker of water-related diseases.
*Ultra poor*: A household was considered ultra poor if it would satisfy at least two of the last three conditions shown in Table B, plus an additional condition from the remaining mentioned.
*Poor:* A household which had 10-100 decimals of land (cultivable and homestead), and sold manual labour for living was considered as poor.
*Non-poor*: The non-poor households were those which did not fall in these two categories.

**Table B. Criteria for selection of hardcore poor and poor households**

| Ultra poor | Poor | Non-poor |
|---|---|---|
| (a) Landless household.<br>(b) Homeless household.<br>(c) Day-labor household head.<br>(d) Less than 10 decimals of agricultural land (1/25$^{th}$ of a hectare).<br>(e) No fixed source of income.<br>(f) Disabled or 65+ years old female-headed households. | (a) Up to 50 decimals (1/5 of a hectare) of land (agricultural and homestead).<br>(b) Sell manual labor for living. | Household that does not fall in any of the other category. |

Source: Seraj 2008.

## SOME RESULTS

### Water

***Arsenic-free tubewell*** — The programme used to educate households to test tubewells for arsenic contamination. However, the overall proportion of arsenic-free tubewell increased at the endline from the baseline, respectively by 3.1% for the ultra poor, 3.7% for the poor and 2.2% for the non-poor.

***Water safety practices at source— To*** reduce the chances of cross-contamination, the project motivated households to construct their latrines so that the tubewells are at an elevated plane compared to latrines. Table 1 shows that overall, the proportion of tubewell placement at the elevated plane from latrine, increased to 12.7% at endline compared to baseline (7.4%), while the remaining were placed either at lower or at the same plane. However, the proportion of tubewells placed at the elevated plane than latrine significantly increased from BL to EL across all economic groups of households, highest was for the non-poor by 92.5%. The proportion of concrete-built platform significantly increased from baseline to end line for all economic groups, but the ultra poor households registered the highest increase by 29.8% compared to poor (by 20%) and non-poor (by 10.6%). Cleanliness of tubewell platform increased from baseline to endline in all economic groups, the poor experienced the highest increase by 139.6% compared to ultra poor and non-poor.

***Water safety during transporting and storing—*** Water safety practices advocated by the project included putting a cover on water jar during carrying and storing water used for drinking and cooking. As shown in Table 2, the proportion of respondents who reported putting a cover on the water jar during transporting drinking water significantly increased from baseline to end line by 41.7%, and during storing by 28.5% ($p<0.000$). Proportion of households reporting to cover water container during transportation of water for cooking also increased by 28.8% at endline compared to baseline ($p<0.001$).

**Table 1. Basic water safety indictors at household (%)**

| *Indicators* | Economic statuses | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Ultra poor | | | Poor | | | Non-poor | | | Total | | |
| | BL (2006/07) | EL (2010/11) | RC | BL (2006/07) | EL (2010/11) | RC | BL (2006/07) | EL (2010/11) | RC | BL (2006/07) | EL (2010/11) | RC |
| Tubewell at elevated plane than latrine | 7.1 | 11.6 | 63.4 | 8.5 | 13.7 | 61.2 | 6.7 | 12.9 | 92.5 | 7.4 | 12.7 | 71.3 |
| *p-value* | *<0.01* | | | *<0.01* | | | *<0.01* | | | *<0.01* | | |
| Tubewell at lower plane than latrine | 17.9 | 24.4 | 36.3 | 21 | 23.6 | 12.4 | 23.1 | 28.1 | 21.6 | 20.7 | 25.4 | 22.7 |
| *p-value* | *<0.01* | | | *<0.01* | | | *<0.01* | | | *<0.01* | | |
| Tubewell and latrine at same plane | 24.1 | 25.2 | 4.6 | 20.4 | 20.1 | -1.5 | 25.4 | 22.6 | -11.0 | 23.3 | 22.6 | -2.9 |
| *p-value* | *<0.01* | | | *<0.01* | | | *<0.01* | | | *<0.01* | | |
| *N* | *291* | *734* | | *591* | *374* | | *1136* | *1346* | | *2533* | *3700* | |
| Concrete built platform | 58.0 | 75.3 | 29.8 | 56.4 | 67.7 | 20.0 | 67.2 | 74.3 | 10.6 | 60.5 | 72.4 | 19.7 |
| *p-value* | *<0.01* | | | *<0.01* | | | *<0.01* | | | *<0.01* | | |
| Clean tubewell platform | 32.0 | 70.6 | 120.6 | 26.5 | 63.5 | 139.6 | 33.30 | 64.3 | 93.1 | 30.6 | 66.1 | 116.1 |
| *p-value* | *<0.01* | | | *<0.01* | | | *<0.01* | | | *<0.01* | | |
| *n* | *431* | *639* | | *952* | *718* | | *2027* | *3017* | | *3,410* | *3,456* | |

BL=Baseline, EL=Endline, and RC=Relative change.

**Table 2. Reported covering of water jar during transporting and storing water for drinking and cooking purposes (%)**

| Indicators | BL (2006/07) | EL (2010/11) | RC | p-value |
|---|---|---|---|---|
| *Drinking purpose* | | | | |
| During transporting | 54.0 | 76.5 | 41.7 | 0.000 |
| During storing | 60.1 | 77.2 | 28.5 | 0.000 |
| *N* | *5759* | *5759* | | |
| *Cooking purpose* | | | | |
| During transporting | 50.3 | 64.8 | 28.8 | 0.000 |
| *N* | *5759* | *5759* | | |

BL=Baseline, EL=Endline, and RC=Relative change.

**Sanitation**

Reported use of sanitary latrine by the households significantly increased by 81.1% from the baseline (31.7%) to the endline (57.4%) (Table 3). In all economic groups, the ownership of latrines significantly increased from baseline to endline, the increase was highest for the ultra poor by 37.3% (from 55.3% to 75.9% of the households) compared to poor and non-poor (Table 4). When the latrines were filled-up (Table 5), the households reported mainly cleaning and reusing the filled-in ring-slab latrines. Such initiative increased from baseline to endline by 33.8% ($p<0.001$), whereas replacement by installing a new latrine decreased by 45.3%. The importance of keeping latrines clean was emphasized in the project. Quality of sanitary latrines increased significantly from baseline to endline in terms of latrine cleanliness by 59.6% (from one-third of the latrines to more than a half). The availability of water in or nearby the latrines for hand-washing and slippers to protect feet, increased by 18.3% and 206.8%, respectively. While unpleasant odour and presence of faecal decreased by -20.3% and -21.4% (Table 6).

| Table 3. Percent of households by types of latrine use (reported) | | | | | |
|---|---|---|---|---|---|
| Types of latrines | | BL (2006/07) | EL (2010/11) | RC (+/-) | p- value |
| Sanitary latrine | Sanitary | 31.7 | 57.4 | 81.1 | 0.001 |
| Unsanitary latrine | Ring-slab without water seal | 37.4 | 26.7 | -28.6 | 0.001 |
| | Pit | 7 | 2.3 | -67.1 | 0.001 |
| | Open defecation | 23.9 | 13.5 | -43.5 | 0.001 |
| *N* | *26404* | | | | |

BL=Baseline, EL=End line, and RC=Relative change.

| Table 4. Reported ownership of sanitary latrines by household economic status (%) | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Ownership status | Ultra poor | | | Poor | | | Non poor | | | All | | |
| | BL (2006/07) | EL (2010/11) | RC (+/-) | BL (2006/07) | EL (2010/11) | RC (+/-) | BL (2006/07) | EL (2010/11) | RC (+/-) | BL (2006/07) | EL (2010/11) | RC (+/-) |
| Own | 55.3 | 75.9 | 37.3 | 66.8 | 76 | 13.8 | 77.9 | 83.3 | 6.9 | 72.8 | 81.2 | 11.5 |
| *p- value* | *.001* | | | *.001* | | | *.001* | | | *.001* | | |
| Shared | 44.7 | 24.1 | -46.1 | 33.2 | 24 | -27.7 | 22.1 | 16.7 | -24.4 | 27.2 | 18.8 | -30.9 |
| *p- value* | *.001* | | | *.001* | | | *.001* | | | *.001* | | |
| *N* | *995* | *1745* | | *1793* | *2504* | | *5558* | *10762* | | *8346* | *15011* | |

BL=Baseline, EL=Endline, and RC=Relative change.

| Table 5. Reported actions taken by households when latrine filled-up (%) | | | | |
|---|---|---|---|---|
| Reported actions | BL (2006/07) | EL (2010/11) | RC (+/-) | p-value |
| Clean and reuse | 29.9 | 40 | 33.8 | 0.001 |
| Install new latrine | 5.3 | 2.9 | -45.3 | 0.001 |
| Not filled | 63.8 | 55.2 | | 0.001 |
| Others | 1.1 | 2.5 | | 0.001 |
| *N* | *14623* | *18637* | | |

BL=Baseline, EL=Endline, and RC=Relative change.

| Table 6. Physically verified indicators describing quality of sanitary latrines (%) | | | | |
|---|---|---|---|---|
| Indicators | | Yes | | p- value |
| | BL (2006/07) | EL (2010/11) | RC (+/-) | |
| Is the latrine clean? | 33.4 | 53.3 | 59.6 | 0.001 |
| Is there any unpleasant odor coming from the latrine? | 62.9 | 50.1 | -20.3 | 0.001 |
| Is there any fecal matter left in the latrine? | 48.2 | 37.9 | -21.4 | 0.001 |
| Fence/wall around the latrine | 98.9 | 99.1 | 0.20 | 0.065 |
| Is there water available in and/or near the latrine? | 32.7 | 38.7 | 18.3 | 0.001 |
| Are there sandals in and/or near the latrine? | 4.4 | 13.5 | 206.8 | 0.001 |
| *N* | *16822* | *21519* | | |

BL=Baseline, EL=Endline, and RC=Relative change.

The transition to use of a safe, sanitary latrine is complex and somewhat fluid. Transition matrix analysis (Table 7) showed that out of 31.7% households that already used sanitary latrines in baseline, about three-fourths (73.3%) continued to do so in endline. Many of the drop-outs shifted to unsanitary practices such as ring-slab latrines without water seals (19.6%) and to open defecation (5.7%). For the 37.4% of the households that used ring-slab latrines but without the sanitary water seal in the baseline, the majority of them (52.4%) shifted to water-sealed, sanitary practices in endline. Of the remainder who did not take up sanitary latrines, about one-third (37.2%) of them carried on the same practice and 7.4% shifted to open defecation. Among the pit latrine users, almost half (46.6%) shifted to sanitary practices, while 33.5% adopted ring-slab latrine without water seal and 8.8% switched to open defecation by the endline. Out of 23.9% of the households who used to defecate in the open places at baseline, 46.4% of them shifted to sanitary practices at endline, while 33.8% kept on following the same practice. Among other things, this

implies that merely counting the number of latrines constructed or renovated does not give a valid understanding of the real situation.

**Table 7. Transition matrix of latrine use in the household (%)**

| | BL (2006/07) | EL (2010/11) | | | |
|---|---|---|---|---|---|
| Types of latrines | | Sanitary | Ring-slab without WS | Pit | Open place |
| Sanitary | 31.7 | 73.3 | 19.6 | 1.4 | 5.7 |
| Ring-slab without water seal | 37.4 | 52.4 | 37.2 | 3 | 7.4 |
| Pit | 7 | 46.6 | 33.5 | 11.1 | 8.8 |
| Open defecation | 23.9 | 46.4 | 17.8 | 2 | 33.8 |
| Total (%) | 100 | 57.4 | 26.7 | 2.3 | 13.5 |

BL=Baseline, EL=Endline, WS=Water seal.

**Water-related disease prevalence**

The prevalence of disease was measured by asking the respondents to recall occurrence of any diseases such as abdominal illnesses, worms, jaundice, etc. to any member of the household during the last 15 days. The overall reported prevalence of water-related diseases significantly reduced from 9.4% in BL to 2.3% in EL ($p<0.001$), an overall reduction of 75.5% (Table 8). The reduction in males and females was also pronounced in EL, higher for females by 78.1% than males by 74.2%. Though the reported prevalence of water-related diseases significantly reduced from BL to EL , the prevalence continued to be highly pronounced among the children 5 years of age or less (BL 21.2% and El 6.6%), compared to more than 5 years olds (BL8% and EL 1.9%) (Table not shown).

**Table 8. Self-reported water-related disease prevalence by sex and survey (%)**

| | Survey | | | |
|---|---|---|---|---|
| Sex | BL (2006/07) | EL (2010/11) | RC (+/-) | p-value |
| Male | 9.3 | 2.4 | -74.2 | 0.000 |
| *N* | *60515* | *60871* | - | - |
| Female | 9.6 | 2.1 | -78.1 | 0.000 |
| *N* | *60641* | *60001* | - | - |
| Total | 9.4 | 2.3 | -75.5 | 0.000 |
| *N* | *121156* | *120872* | - | - |
| p-value | 0.054 | 0.006 | - | - |

BL=Baseline, EL=Endline and RC=Relative change.

## DISCUSSION

**Basic water safety issues:** The findings reveal a modest but significant improvement in tubewell water use especially for drinking and cooking between baseline (2006/07) and the endline surveys (2010/11). Repeated health education and provision of arsenic mitigation options may help bring such a positive change. Improvement in water safety practices at source, during transporting and storing of water was also evident with more than 3 out of 4 households covering drinking water during transportation and storage at home. Previous research shows significant improvement in some sanitation indicators such as construction of concrete-built tubewell platforms and maintaining their cleanliness, thus reducing the chances that contaminated water returns into the wells. Cleanliness of tubewell platforms were pronounced among ultra poor households indicating equity in this regard. Rigorous promotion of water safety plan and loan support to implement the safety measures at household level may have contributed to behaviour change **(Dey *et al.* 2011).** Collection, transportation and storage of safe water in uncovered containers are likely to be contaminated by germs from the environment. Thus, improvement in putting cover on water containers during carrying and storing water implies that the BRAC intervention goes beyond raising awareness to the development of safer practices for water use and maintenance at the household level. Another study corroborates this finding **(Duncker 2000).**

**Sanitation:** Poverty and the physical environment often pose barriers to ownership, use and maintenance of sanitary latrines. The breaking of the toilet's water seal is an immediate problem mainly because of water shortage or lack of consciousness. If effectively motivated, these toilets with water seal-broken latrines could be converted into active water seals, hence increasing the overall coverage. According to some users, water-sealed latrines are inconvenient in terms of use and maintenance **(Quazi 2002**). A large amount of water is required to wash out the latrine after each

use, which is difficult to afford or perhaps there is a design issue to be explored, that will require a small amount of water to flush the toilet after each use.

Households shifting into sanitary practices are higher than reverting to unsanitary practices implying that people are increasingly adopting improved practices. Households, whose latrines had become unsuitable due to filled pits or breakage and had not emptied the pit or installed a new pit/latrine at the time of the endline survey in 2010/11, may tend to defecate in the open places. **Hanchett *et al.*** (2011) explain that rural households often slip back to old habits if new latrines become blocked, broken or smell bad, and if nobody is there to guide and encourage them at the right time.

Data from this survey showed that more than half the latrines were clean in 2010/11 compared to about one-third in 2006/07. Thus, while the proportion of sanitary latrines improved from baseline to endline, all the sanitary latrines are not hygienically used. **Ghosh *et al.*** (2010) found improvement in hygienic latrine use in WASH intervention areas where households were strongly motivated through training and door-to-door visits by village WASH committees. In this study, the successful committee also monitored sanitary latrines at the household level and educated mothers who were usually in charge of household hygiene. **Hanchett *et al.*** (2011) emphasizes households' behaviour change to improve quality of sanitary latrines. The authors also emphasize that a high proportion latrine ownership does not ensure improved public health if those latrines are not hygienically maintained and used.

**Water-related disease prevalence:** The prevalence of water-related diseases remarkably decreased at EL compared to BL. Earlier studies substantiate this finding **(Fewtrell *et al.* 2005a; Fewtrell *et al.* 2005b**). This might imply that prolonged interventions enable the implementers to reinforce new practices continually, helping to bring about a reduction in the occurrence of related diseases.

Sex differences in the prevalence of water-related diseases faded away at endline study in 2010/11, that is, females had significantly lower reported prevalence of disease than males at EL. This can be explained by the fact that the BRAC WASH programme is highly women-focused, and the reversal of sex disparity may be an outcome of this. However, removal of sex disparity has immense implications in a society where all forms of discriminations against women is pervasive, women-friendly healthcare is less likely, and they infrequently use health services during illnesses (**Young *et al.* 2006).**

Children under five years of age were more likely to get water-related diseases. Studies report that most of the excess disease burden in LICs falls on young children—17% of all deaths in children under-five years are attributed to diarrhoea and inadequate water supply is a contributor to deaths in children (**Clasen *et al.* 2007**). This also indicates that the knowledge and good practice of child healthcare is poor among the mothers/caregivers.

**Limitations**: The study suffers from some methodological limitations. Therefore, one should be careful in interpretation of the results.

(i) There was a seasonal variation in data collection of baseline during November to July 2006/07, and EL during December to February 2010/11. This may have had an impact on the prevalence of water-related diseases as research shows that incidence of water-related diseases varies between the seasons **(Cilmate Change Cell 2008)**. However, as these medical conditions are common and endemic in Bangladesh round the year, the seasonal effect would be minimal.

(ii) There was no comparison group, meaning that it was not possible to investigate whether the changes found in the BRAC project population were related only to the project itself, or to other intervening variables. However, the longitudinal nature of the study, showing change over time and the randomness of the selection of study participants imply that at least some of the changes are attributable to the interventions.

(iii) The prevalence of water-related diseases was not confirmed by microbiological pathogens tests, which may bias the prevalence rate. However, the strengths of the study including separate teams of field investigators for data collection during baseline, and endline, and analysis of data of the same households for both the surveys might help avert information bias.

## CONCLUSION

The study reveals an improvement in the access to arsenic-free water from tubewell at the aggregated level (BL 68.4% vs. EL 71.2%; an increase by 4%). Likewise, improvement was also evident in water safety practices at source (glean platforms), during transporting and storage. But presence of arsenic in the tubewell water is the main impediments of 100% safe water use. Evidence showed improvement in ownership and use of sanitary latrines at household level. However, a number of factors such as poverty, lack of awareness or entirely effective promotion and water shortage induce households to adopt unsanitary practices. Households whose latrines became unsuitable for use in endline, but did not take any action to repair, or empty the pit, or install a new latrine will be subject to increased motivation for future progress. Technological innovations are needed for devising toilets that will require a small amount of water to flush after each use and also to prevent breaking of water seals. A significant reduction in the prevalence of water-related diseases and sex disparity was taken place over time. This suggests that a reasonably well-implemented intervention can improve water, sanitation and hygiene conditions leading to reduced water-related diseases prevalence.

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