

34th WEDC International Conference, Addis Ababa, Ethiopia, 2009

**WATER, SANITATION AND HYGIENE:
SUSTAINABLE DEVELOPMENT AND MULTISECTORAL APPROACHES**

**Monitoring impacts of WASH interventions:
The case of SHEWA-B**

Richard B. Johnston^{1}; Amal K. Halder²; Tarique Md. Nurul Huda²; Shamima Akhter²;
Amanullah-al-mahmood³; Md. Rashidul Huque³; Arthur Tweneboaa-Kodua¹;
Carole Tronchet¹; Stephen P. Luby²; Bangladesh*

REFEREED PAPER 281

UNICEF and its government counterpart are implementing a large WASH programme with explicit behavioural change goals. A baseline survey showed that handwashing with soap (HWWS) was most frequent after defecation (17%) or cleaning a child's anus (23%), and lowest around food-related events (<1%). Observed practices are sharply poorer than self-reported behavior. After one year, significant improvement was noted in handwashing practices following contact with faecal matter, but HWWS before preparation, serving or eating of food remained stubbornly low. Open defecation had declined, most notably in the poorest quintile. Morbidity was not significantly different in control and intervention households. However, intervention households were significantly more likely to have coliform-free household water (48%) than were control households (32%). This robust monitoring framework has allowed the project to understand WASH practices in the target communities in detail, and to identify areas of success and areas where efforts need to be redoubled.

Introduction

UNICEF and its government counterpart, the Department of Public Health Engineering (DPHE) are implementing SHEWA-B (Sanitation, Hygiene Education and Water Supply in Bangladesh), with the overall goal of helping Bangladesh to achieve the Millennium Development Goal (MDG) targets directly related to water and sanitation, and contributing significantly other MDG targets, particularly relating to under-five mortality rates. In the first of two phases, the programme aims to cover a population of 19.6 million people living in rural areas.

The project uses participatory methods at the community level to develop Community Action Plans (CAPs) which include targets for improvements in latrine coverage and usage; access to and use of arsenic-free water; and improved hygiene practices, especially handwashing with soap (HWWS). More than 10,000 field workers are engaged for intensive interventions at the community level, following up on CAPs through household visits, tea stall sessions and courtyard meetings, as well as various social mobilization activities such as WASH fairs, village theatre, etc. Field activities are planned for three years, to be followed by a fourth year of gradual phasing out.

The project expects that improved hygiene practices (especially HWWS) will result in reduction of both diarrheal disease as well as acute respiratory infection (ARI). In order to measure SHEWA-B contributions towards behavioural change and MDG targets, ICDDR,B has been contracted to design and conduct a large Health Impact Study (HIS), which includes a baseline survey and several follow up surveys as part of a longer monitoring process. The HIS uses state-of-the-art methods to measure WASH practices at the household level, and to quantify the relationship between these practices and morbidity and mortality from diarrheal disease and ARI.

Methods

SHEWA-B is being implemented in 68 sub-districts throughout Bangladesh, which were systematically selected considering poverty, sanitation coverage, safe water access (including arsenic), and diarrheal disease burden. Sub-districts are further divided into unions, and SHEWA-B covers all unions within a project sub-district. We listed all of the unions in the 68 sub-districts and randomly selected 50 unions where the probability of selection was proportional to the size of the union. These unions were matched with 50 control unions outside of the SHEWA-B programme area, where no other large WASH interventions were running, and where geographical and social conditions were judged to be similar. Within each union one village was randomly selected.

Residents of these 100 villages were asked to identify the center of the village, and field workers enrolled the household closest to the village center that had a child <5 years of age and agreed to participate in the evaluation as the first household. To enroll the next household, fieldworkers skipped the next two closest households, and then looked for the next household with a child <5 years of age. Field workers repeated the process for enrolling additional households until 10 households in each selected village were enrolled, for a total of 500 intervention and 500 control households.

The HIS consists of a series of related surveys and assessments made in these 100 villages.

A **baseline assessment** of WASH practices was conducted in Summer 2007 by trained field workers who performed 5-hour structured observations of handwashing behavior of all persons in all selected households (n=1,000). Using a pre-tested instrument, they noted handwashing behavior at key times -- before preparing food, before eating or feeding a child, after defecating and after cleaning the anus of a child who had defecated. Field staff also recorded the type of water and sanitation infrastructure used, and collected samples of household water for arsenic analysis.

An **interim assessment** was made in Summer 2008, in which only intervention households were visited, to get an early indication of whether the programme is starting to have an impact. A **midline assessment** is planned for Summer 2009, after which the intensive phase of the intervention is planned to be completed. At least one year after the project withdrawal (i.e. Summer 2011), an **endline assessment** is planned to determine the sustainability of project impacts.

The structured observation survey was followed two months later by a more conventional **cross-sectional survey**, which used a questionnaire included standard demographic characteristics, WASH indicators, and possessions to permit a measurement of acquired household wealth using asset analysis. To gain greater statistical power for certain indicators, 7 additional households were enrolled from each village (n=1,700).

A disease burden survey was made in 17 households per starting point, to find out baseline morbidity and to gain detailed information about health-seeking behavior and the financial burden of diarrheal disease and acute respiratory infection (n=1,700).

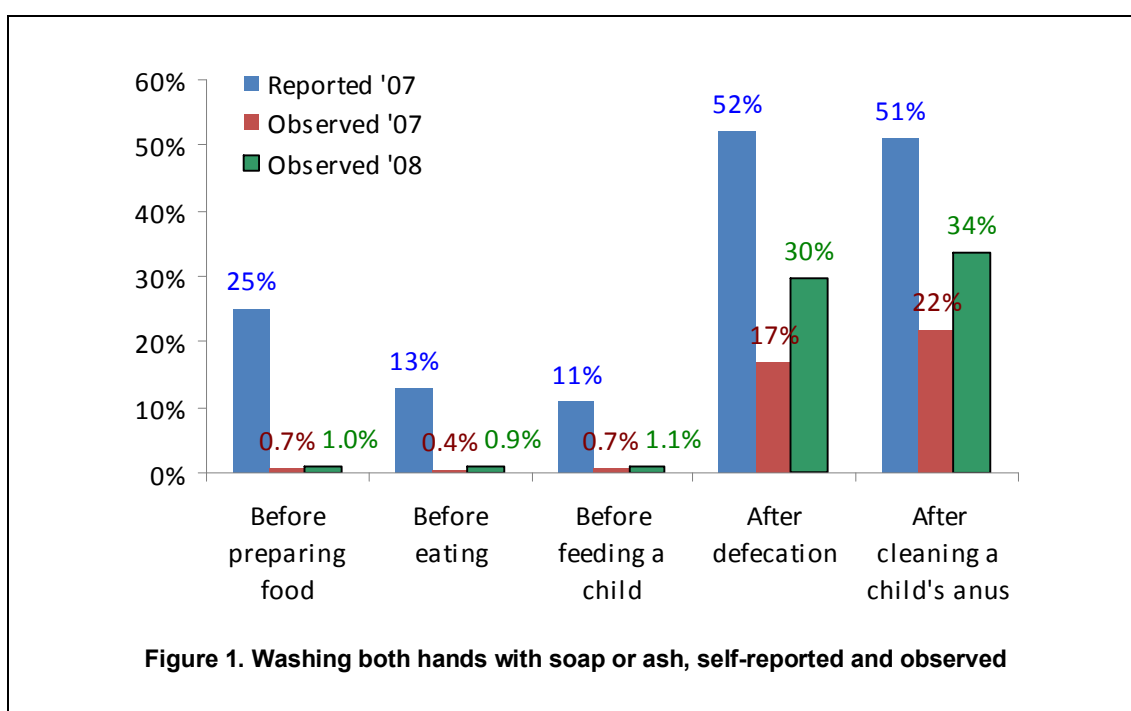
A **sentinel surveillance system** was established in 10 households per village, in which trained community volunteers record self-reported disease burden each month, in return for a small stipend. Household water samples are measured for *E. coli* on a quarterly basis (n=1,000). Quarterly reports began in Winter 2007 (Oct-Dec) and will continue for two years.

A **mortality assessment** was made in these 100 villages in late 2007. Since mortality is a very rare event compared to other indicators of interest, the required sample size was much larger. In each village, 110 households were visited (n=110,000), and heads of households asked if there had been any child death within the last four years. When child deaths were reported, a separate verbal autopsy team visited the household to determine the cause of death.

Results

Handwashing

Among the 20,546 key times observed in the baseline assessment, study subjects were observed to wash their hands 11,800 (55%) of the time, though in only 350 episodes (1.7%) did they wash both hands with soap or ash. Handwashing with soap (HWWS) using both hands and soap or ash was most frequent after defecation (17%) or cleaning a child's anus (23%), and lowest around food-related events (<1%), which were more common. Observed practices are in sharp contrast to the questionnaire data, where about 50% of respondents reported HWWS after defecation and 10-25% before handling food (Figure 1).



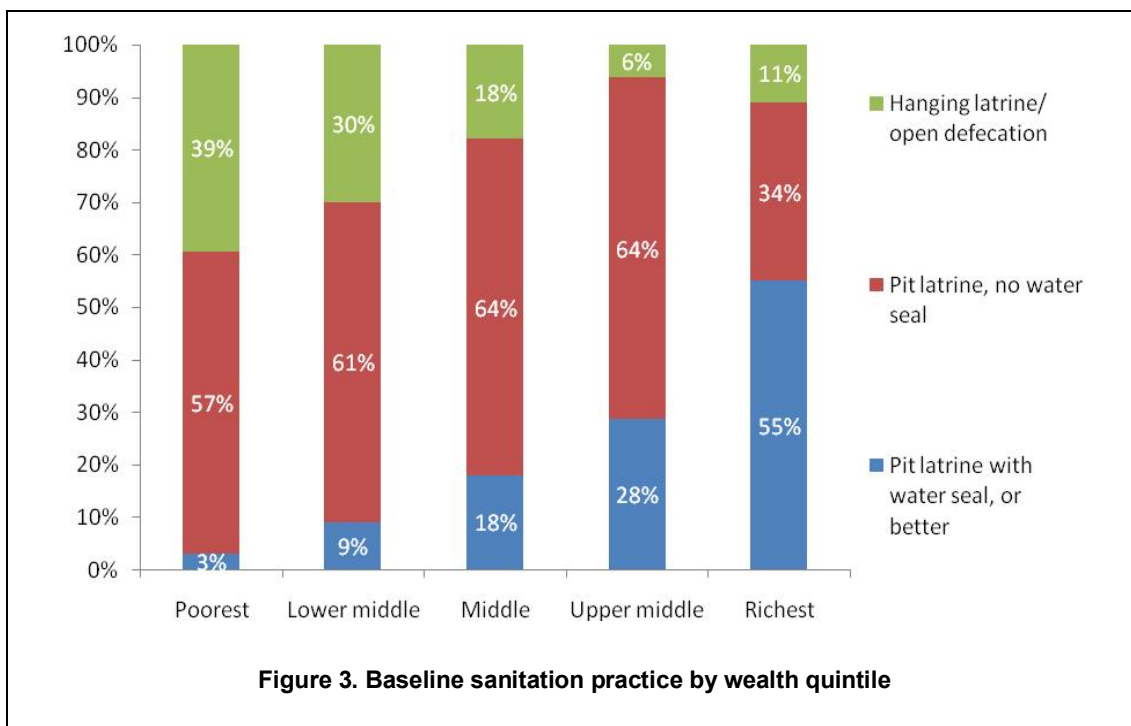
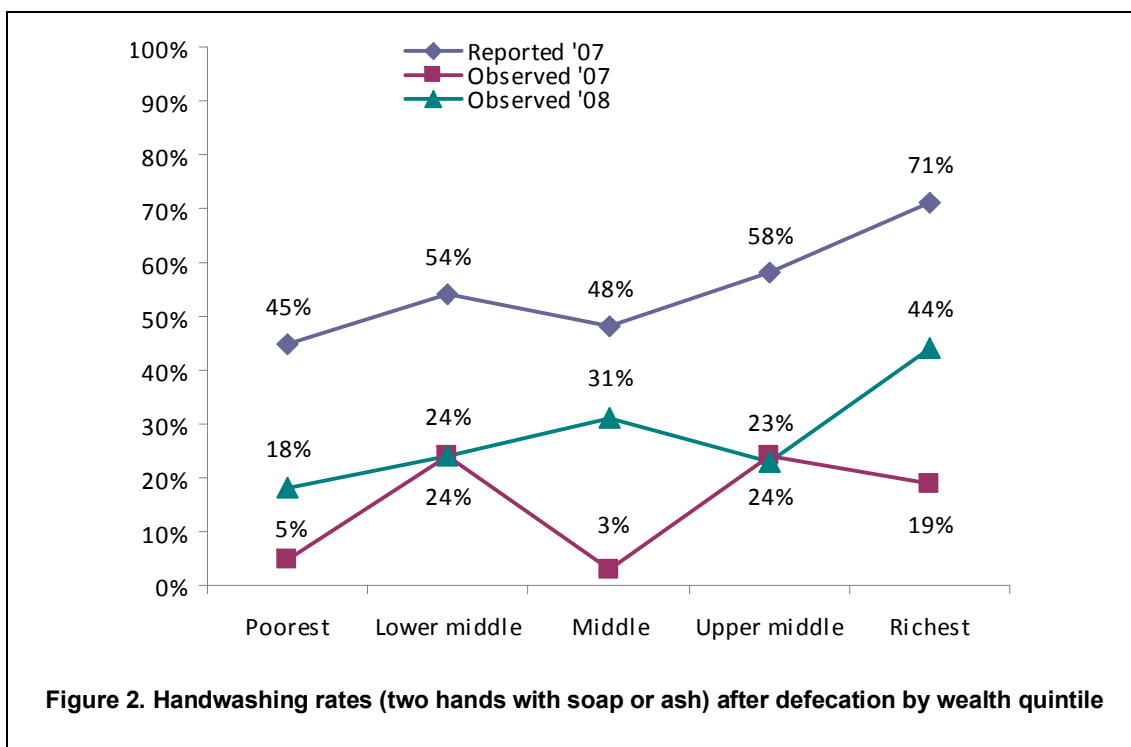
More than 90% of household members did wash hands in some way after defecation, but usually one hand only, and without soap or ash. HWWS was more common in less poor households, and in households where the mother was more educated. Where water or soap was available at the handwashing place, handwashing rates were doubled. However, the location of the handwashing place (e.g. at the latrine, near the kitchen, or elsewhere in the yard) had no significant effect on handwashing rates.

Wealthier respondents were much more likely to report HWWS after defecation, but observed practices did not follow a clear trend with wealth status (though practices were better in the top two quintiles) (Figure 2).

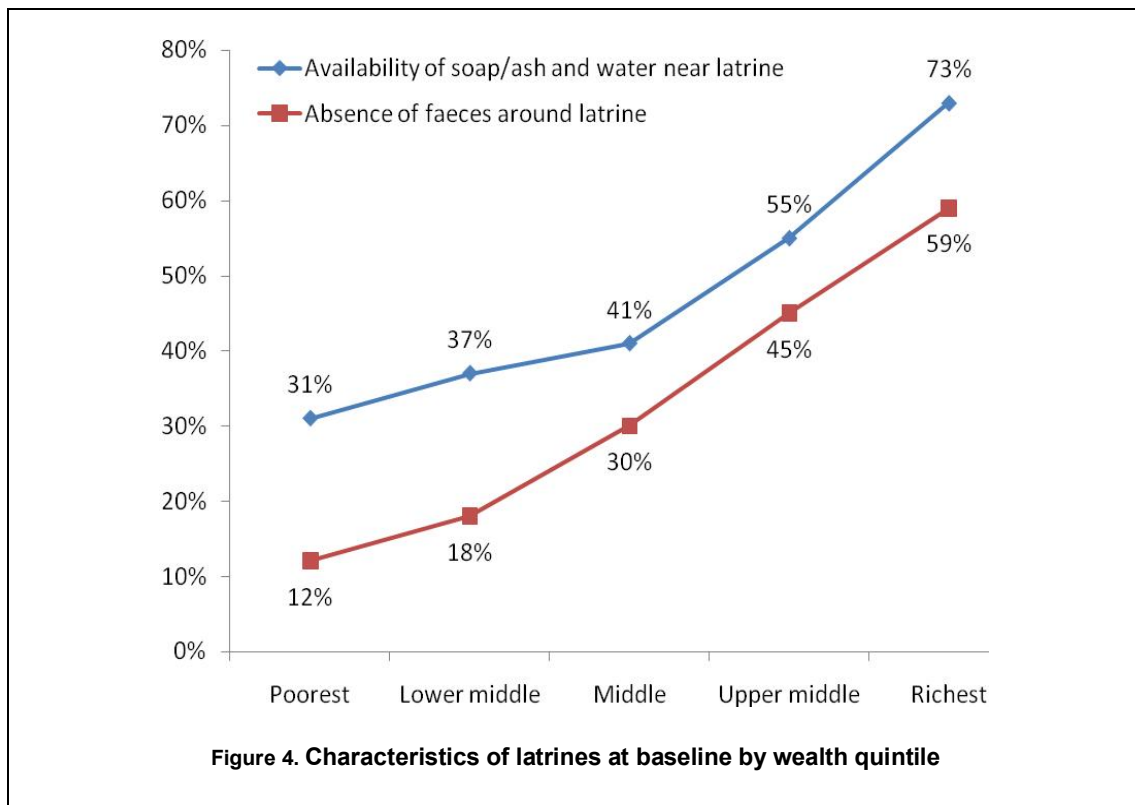
In the **interim assessment** made in Summer 2008, one year after the baseline and approximately six months after the start of the intensive intervention, some changes were seen. Significant improvement was noted in observed handwashing practices following contact with faecal matter (rising to 30% and 34% after defecation and cleaning child's anus, respectively). Improvements were stronger among men than women, perhaps because their baseline practices were poorer. However, HWWS before preparation, serving or eating of food remained stubbornly low, at less than 1%. It must be noted that as the interim assessment did not include control households, it is not possible to clearly attribute the improvements to the project.

Sanitation

The baseline assessment found that the majority of respondents (56%) were using a simple pit latrine, without water seal. This latrine is considered improved by the WHO/UNICEF Joint Monitoring Programme, and should be counted as progress towards the MDG target. In addition, 23% of households were using more hygienic latrines (with water seals) or more sophisticated options such as off-set pit latrines or toilets with septic tanks. Therefore 79% of households were considered to be using improved sanitation facilities.



There was a clear relationship between sanitation practices and wealth, with more than a third of the poorest quintile practicing open defecation or using hanging latrines draining directly into surface water bodies (Figure 3). Likewise, wealthier households were much more likely to have soap and water available near the latrine, and to have a clean latrine free from visible faecal matter (Figure 4).

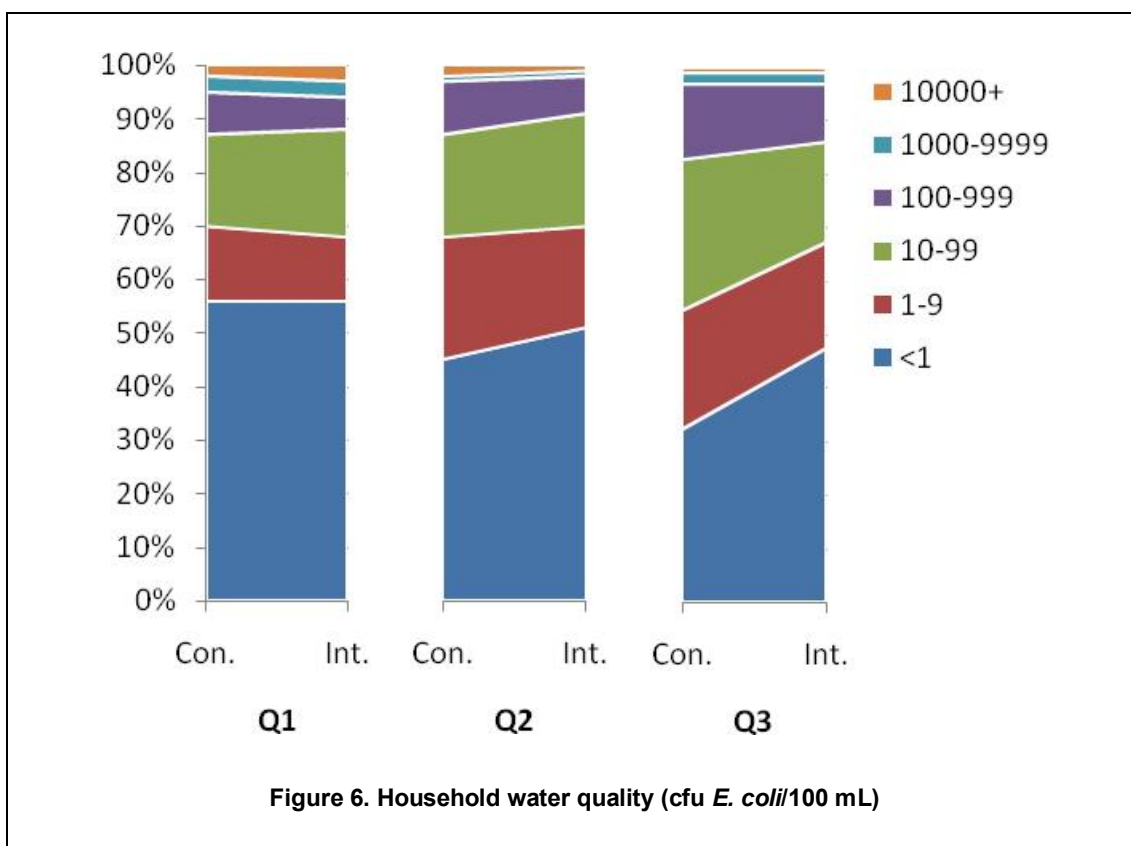
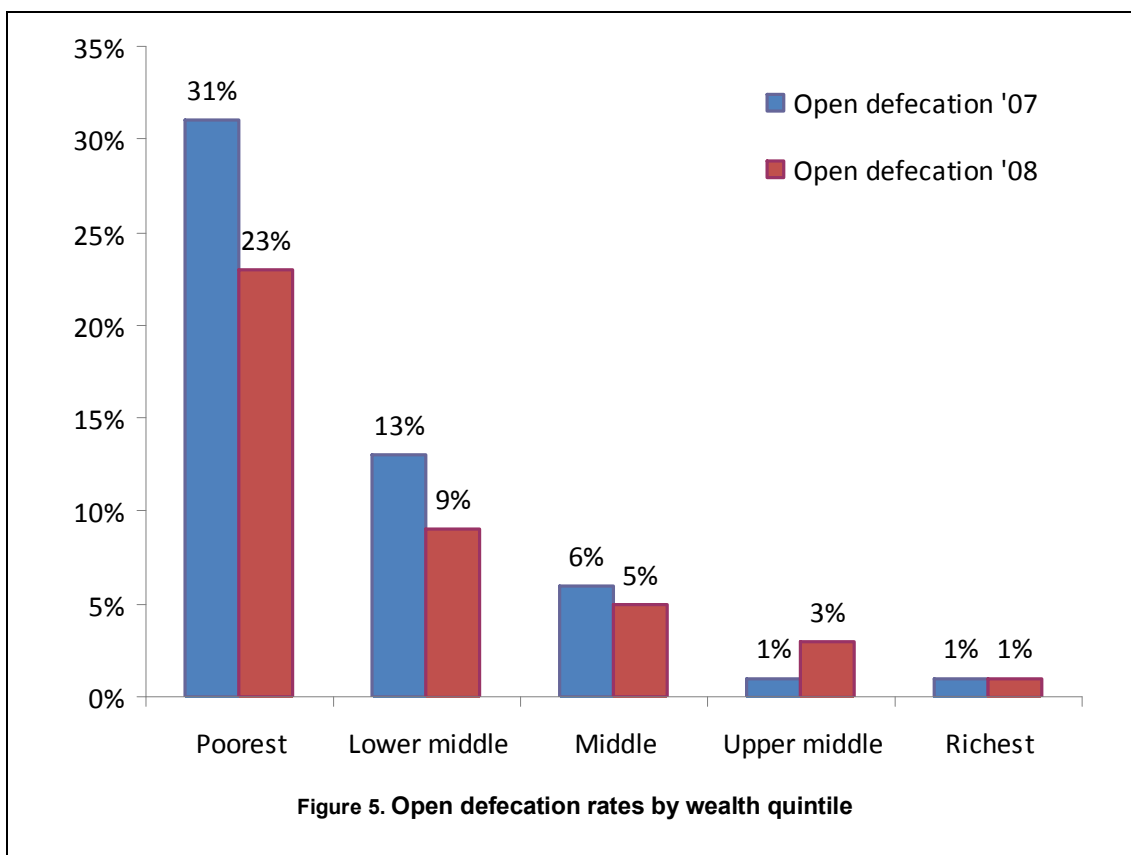


At the one-year interim assessment, modest gains had been made in sanitation coverage, with improved latrine coverage rising from 79% to 84%. Open defecation had declined from 10% to 8%, with a more substantial reduction seen in the poorest quintile (Figure 5). The proportion of latrines having no visible faecal matter increased from 31% to 39%. However, progress towards safe disposal of child faeces was unsatisfactory, increasing only from 9% to 11%. Similarly, availability of appropriate solid and liquid waste disposal systems at the household was very low (<3%) at baseline and in the interim assessment.

Water

The baseline assessment showed that 24% of water samples collected from households in the SHEWA-B villages contained arsenic levels above the government limit of 50 parts per billion (ppb), while 41% exceeded the WHO provisional guideline value of 10 ppb. In contrast, only 7% and 25% of samples exceeded these limits in the control households. This demonstrates clearly that the project area selection process successfully prioritized arsenic contamination. In the intervention areas, 10% of households contained extremely high levels of arsenic, above 300 ppb. The next round of arsenic testing will be done in the 2009 midline assessment.

As part of the sentinel surveillance system, household water samples are collected every quarter and analyzed for *E. coli*. In both intervention and control areas, microbiological water quality deteriorated between the first and third quarters of surveillance, possibly due to seasonal effects. At baseline 56% of households in both intervention and controls areas had coliform-free water (<1 cfu *E. coli*/100 mL). However by the third quarter SHEWA-B households were significantly more likely to have coliform-free household water (48%) than were control households (32%) (Figure 6).



Disease burden

The baseline survey showed that respiratory and diarrheal illnesses were common among children in the SHEWA-B area. Sixty percent of children under 5 had at least one symptom in the last two weeks, and 2.5% of children had been hospitalized in the last year. Disease prevalence was similar among boys and girls, but boys were more likely to receive care. Taken together these data confirm that diarrhea and respiratory disease are widespread, and suggests that there is sufficient scope to assess differences that the SHEWA-B intervention may bring.

Costs of hospitalization were high at more than 1000 Taka (\$15) per event on average. However, outpatient care is much more frequent and accounts for more than 80% of the average cost of 260 Taka (\$4) per child per year. Among the SHEWA-B population of 30 million people, about 137 crore Taka (\$20 million) is spent annually on care for diarrhea and respiratory illness.

After nine months of observation through the sentinel surveillance system, morbidity was not significantly different in control and intervention households, for either diarrheal disease or respiratory infection. There was some indication that 'difficulty in breathing', a symptom of respiratory infection, was lower in the intervention communities (10%) compared to control communities (12%) by the third quarter. If this trend continues it suggests a difference in respiratory disease experience between intervention and control communities. Data from the mortality assessment have been collected and are currently being entered and analyzed, with results expected in early 2009.

Discussion

SHEWA-B is a large and complex project with the highly ambitious goal of changing fundamental WASH behaviours at scale. Such a project requires a sophisticated monitoring system, both to track progress and gather knowledge to make any necessary changes; and to be able to attribute any measured impacts to the intervention. The Health Impact Study is one important component of the SHEWA-B monitoring and evaluation framework.

Households surveyed in the HIS were carefully chosen through a randomized selection method in both intervention and control communities. The general characteristics of intervention and control communities, as well as their sanitation and hygiene practices (but not their arsenic exposure) were broadly similar, and the existence of a solid baseline in both intervention and control areas will be critical in attributing any change to SHEWA-B. For example, the household water quality data gathered through the sentinel surveillance indicate a deterioration in microbiological water quality over the first nine months in SHEWA-B households. But examination of the data from the control population shows that an even more pronounced deterioration has occurred in those households, indicating a general seasonal trend. Without the control areas in the HIS, the actual positive impact of SHEWA-B on household water quality would appear a negative impact.

There are many different ways to characterize poverty. Asset analysis is an operationally simple and increasingly used tool for poverty analysis, and is now common in surveys such as MICS and DHS. Use of asset analysis in the HIS has allowed important observations to be made about differences in baseline status and impacts for different socio-economic strata. We have also made other poverty classifications using Government definitions and considering communities' own perceptions; these classifications match the asset analysis poverty analysis fairly well.

Increasing rates of handwashing with soap, in order to reduce disease burden, is a major objective of SHEWA-B. Handwashing practices are notoriously difficult to measure, and we have used multiple metrics to assess them. The structured observation data clearly show, as has been documented elsewhere, that actual handwashing practices are much lower than self-reported data would suggest. While many surveys have collected data on HWWS in Bangladesh, nearly all have relied on questionnaires and self-reporting. The HIS provides the first major survey of actual handwashing practices in rural Bangladesh, and many sector stakeholders have been surprised and even unbelieving that actual HWWS rates are so low. It is possible that even the rates found through structured observation are subject to bias, since people may behave differently in the presence of an observer (so-called reactivity). However, if this were the case we would expect true HWWS practices to be even poorer than observed through the HIS.

The low baseline rates of HWWS present a challenge and an opportunity – significant improvements in disease burden can be expected if HWWS rates do increase substantially. The study demonstrated that some form of handwashing is widely practiced in rural Bangladesh. Even though the dominant practice of rinsing

one hand with water only is ineffective in reducing pathogen levels, interventions can build upon and improve this practice, rather than seeking to introduce an entirely new concept of hand-cleaning.

The HIS has clearly shown that handwashing practices are very different for food-related and defecation-related events. Use of soap/ash for the latter is somewhat established at baseline and SHEWA-B may have already had a significant impact on increasing rates in the first year (since the interim assessment was not made in control areas firm attribution is impossible). However use of soap for handwashing before preparing, serving, or eating food is much lower, as should be expected. In Bangladesh culture the left hand (used for anal cleansing) is unclean, and the right hand is used for eating. It may be acceptable to touch the two hands together after defecation in order to remove faecal matter which is inherently disgusting. But it is another matter completely to touch the two hands together directly before contacting foods, at a time when the hands are not perceived as particularly contaminated. SHEWA-B is currently reviewing and updating its communication materials, and following the HIS findings, will attempt to target food-related handwashing practices separately.

Likewise, the surveys show that safe disposal of child faeces is not improving to the level desired, and the project will redouble efforts in this respect. The fact that the rates of HWWS after cleaning a child's anus are relatively high gives some indication that people can be convinced to consider child faeces to be unclean.

This robust monitoring system has allowed the project to understand WASH practices in the target communities in detail, and to identify areas of success and areas where efforts need to be redoubled. Besides helping the SHEWA-B team fine-tune the intervention, and allowing robust measurement of impacts, the data from the HIS have contributed substantially to broader sector knowledge, in Bangladesh as well as globally. ICDDR,B has a knowledge management strategy for dissemination of HIS findings which includes presentations at seminars, conferences, and publication in informal as well as peer-reviewed journals.

High quality data do not come cheaply: UNICEF will spend more than \$750,000 dollars on the first two and a half years of the Health Impact Study (ICDDR,B also makes a substantial financial contribution). However, when it is considered that the total cost of SHEWA-B is approximately \$100 million, the large investment in the HIS becomes understandable. A standard rule of thumb is that M&E should comprise 5-10% of project budgets, and the total cost of SHEWA-B's M&E framework (including the HIS, an external monitoring agency, various studies, etc.) represents nearly 5% of the budget. About one third of the funds spent to date on M&E have been for the HIS. So, as a proportion of the budget the cost of the HIS is reasonable, but in dollar terms it is very costly and it was a challenge to convince some stakeholders to invest so heavily in the surveys. However this investment is now paying off, and it is hoped that the HIS can serve as an example for other large WASH programmes as they design their monitoring and evaluation frameworks.

Acknowledgements

The financial support of the United Kingdom Department for International Development is gratefully acknowledged.

Note

1. UNICEF Bangladesh
2. ICDDR,B
3. Bangladesh Department of Public Health Engineering.

Contact details

Richard B. Johnston
UNICEF Bangladesh
Tel: +880-2-9336701
Fax: +880-2-9335641

Email: rjohnston@unicef.org

Richard.Johnston@eawag.ch [from June 2009]

www: www.unicef.org/bangladesh

Tarique Md. Nurul Huda
ICDDR,B, Bangladesh
Tel: +880-2-8860523

Fax: +880-2-8826050

Email: tariqueh@icddrb.org

www: www.icddrb.org
