Fighting arsenic at the grassroots: experience of the community awareness initiative of BRAC in Bangladesh

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Summary

The study evaluates the arsenic mitigation project of BRAC in raising the awareness of arsenic poisoning in the rural communities in Bangladesh. Data came from the selected villages in the south-western Bangladesh where BRAC had arsenic mitigation project. Comparison villages were also selected from the same region. A total of 1,240 randomly selected adult persons were interviewed in May 2000. Findings reveal that the mitigation project played a significant positive role in raising awareness of the safe water options, signs of arsenicosis, mode of transmission and the type of treatment. Testing tube-well water for arsenic created curiosity, innovations and interest in the community. Similarly, water treatment plant became a symbol of arsenic campaign that created the context for promoting awareness. The study concludes that the behavioural change aspects of the arsenic mitigation project have the potential to significantly improve the level of understanding about arsenic contamination in the traditional communities.

Introduction

Bangladesh is facing perhaps the largest mass poisoning in history. Millions of the population are expected to experience a slow and painful death from arsenic poisoning over the next decades unless they are provided alternatives to drinking contaminated well water (Bearak 1998; Schmetzer 1999; Smith, Lingas and Rahman 2000). While it is still unknown how many people are drinking the poison, the conservative estimate suggested that nearly 35 million people in Bangladesh would be affected by arsenic contamination (Ahmad et al. 1999; Khan et al. 1997). Among those, nearly 21 million people would be exposed to arsenic concentrations above the Bangladeshi standard[1] of 0.05 mg/l (BRAC 2000). The arsenic has probably been present in the ground water for thousands of years. It is widely believed that the contamination occurred only recently because of the extensive use of groundwater for drinking and irrigation purposes in the rural areas since 1960s (British Geological Survey 1998).

The arsenic poisoning is manifested primarily in skin lesions on the palms of the hands and soles of the feet. Chronic exposure can cause adverse health effects including skin and lung cancer (Hopenhayn-Rich *et al.* 1998). The process may take between five and fifteen years to reveal clinical manifestations of arsenicosis (British Geological Survey 1998; Guha Mazumder *et al.* 1998). Studies conducted elsewhere report that arsenic affects many organs and systems in the body such as skin (Tondel *et al.* 1999), heart vessels (Abernathy *et al.* 1999), respiratory organs (Guha Mazumder *et al.* 2000), and kidneys (Kurttio *et al.* 1999) that may lead to the development of lung, kidney and bladder cancer (Hopenhayn-Rich *et al.* 1998; Hindmarsh 2000).

The discovery of arsenic in drinking water in Bangladesh has created concern for its potential health effects. It has also become a great challenge for provision of safe water to over 97% of the population now uses water from tube-wells. It took many years to convince the people to use tube-well water since it was free from pathogenic micro-organisms. Now, the task is to convince the people again that tube-well water has also problems and that adopting preventive measures are essential. As part of the arsenic mitigation strategy, the government and several development organisations have been implementing arsenic awareness campaign throughout the country.

Arsenic awareness initiative of BRAC

As part of its mitigation[2] strategy, BRAC (a non-government development organisation in Bangladesh) designed an arsenic awareness project to inform the community about the risks of drinking contaminated water, aware regarding safe water options, signs of arsenicosis, mode of transmission and the type of treatment of the disease. The mitigation project also included the demonstration of safe water options and the involvement of the community in the process.

A combination of several approaches was used in raising knowledge about arsenic contamination and the consequences of drinking arsenic water on human health (BRAC 2000; Halim 2000). The communication strategy of the project was designed to inform rather than indoctrinate the people regarding arsenic poisoning and other relevant issues. They were given the opportunities to think rationally, find alternatives and determine their own position in resolving the arsenic problems. The key features of the process included meetings with community leaders; workshops for health service providers, school teachers and religious leaders; group meetings with the neighbours during testing tube-wells for arsenic; and the distribution of posters and leaflets at the key public places. The assumption has been that more information from multiple sources would lead to increased knowledge that would help positive behavioural changes (Bradley, Waliczek and Zajicek, 1997; Pinfold 1999).

BRAC used its community health workers to communicate people at the grassroots. The health workers were selected from among the village women with few years of schooling. They were given two-day training by a group of para-professionals of BRAC. The training included intensive classroom discussion on selected issues such as safe water options, signs of arsenicosis, the mode of transmission and the prevention of the disease. The health workers were also trained to test arsenic in the water by using field kit and to identify the patients. After completion of the training, they were expected to visit each household to identify the patients and arsenic contaminated tube-wells, to demonstrate the visual symptoms of arsenicosis, to reduce the misconceptions of the transmission of arsenicosis and to educate people regarding the prevention of disease in the community.

In the beginning of the project, a series of community-based meetings were organised by BRAC where arsenic problems and mitigation options were discussed. The first meeting covered the intensity of the arsenic problem and the need of testing tube-wells. The second meeting was held just after the completion of the testing to share the test results with the villagers. During this meeting, the potential safe water options and their relative merits, approximate costs of different options, maintenance of the options and the selection of possible demonstration sites were also discussed. In the subsequent meetings, the villagers were motivated to use options and encourage them to participate in monitoring, operation and maintenance of the safe water options. After completion of one year of the mitigation projection, it was decided that an assessment should be made to review the strengths and weaknesses of the project, and identify the future course of action. Given this backdrop, this study assesses the contribution of the arsenic mitigation project of BRAC in raising awareness of the community. Four aspects of community awareness viz. sources of safe water options, signs of arsenicosis, mode of transmission and the type of treatment, are considered for this research recognising that such a limited coverage reflects only a part of the evaluation of the arsenic mitigation project.

Methodology

Data

This study was conducted in selected villages in the south-western Bangladesh where BRAC had both arsenic project (mitigation area) and a demographic surveillance system.[3] A number of comparison villages was selected from the adjacent district in the same region where BRAC had no arsenic project (comparison area) but only the surveillance system.

The surveillance system database was used to develop the sampling frame. All adult population aged between 15 and 74 years were considered to be included in sample. Two sampling frames for both men and women were constructed. Systematic random sampling technique was followed to select samples from both study areas. The total sample size was 1,240 where 636 from the mitigation and 604 from the comparison villages were selected for this study. A test instrument was developed for the assessment of the knowledge comprised of 12 items in four issues such as safe water options, signs of arsenicosis, mode of transmission and the type of treatment. Sample survey and in-depth interviews were used to collect data. The survey was conducted in May 2000.

Analytical procedure

In this study, the effects of the arsenic awareness initiative in improving the knowledge of arsenic contamination were examined. The improvement of awareness was assessed by four dichotomised dependent variables[4] such as safe water options, signs of treatment, mode of transmission and type of treatment are used. Several confounding variables such as age, education, family income source,[5] media exposure and the land ownership were considered to influence the knowledge of arsenic-related issues. In the analysis, the differences in various measures of knowledge by the mitigation project are presented. Then simple bi-variate relationships between the measures of knowledge and the socio-economic variables are discussed. To assess the net effects of the mitigation project on arsenic awareness, multivariate analysis was done. The logit model was considered appropriate because the dependent variables were dichotomous (Aldrich and Nelson 1994). In the absence of longitudinal data, the factors that might be influenced by endogeneity or selection bias were adjusted by employing multivariate analyses.

Table 1 here

Results

Profile of the population

The differences in socio-demographic characteristics of sample population by their exposure to arsenic mitigation project are shown in Table 1. No significant variation in age of the population between the two areas was found. The distribution of sample by sex was kept equal in both study areas. Although they were poorly educated, the years of schooling was higher in the mitigation than comparison villages ($P<0.01$). About 41% were exposed to media although the difference in the proportion exposed to media between the study areas was not significant. The families in the mitigation area had more land than families living in the comparison area ($p<0.01$). The proportion of families who survive on selling their manual labour was significantly higher in the comparison than mitigation villages ($p<0.01$). Overall, the socio-economic condition was better in the mitigation than comparison villages.

Table 2 here

Difference in knowledge components

The differences in the level of knowledge between the mitigation and comparison areas, as shown in Table 2, indicate the contribution of the awareness initiative of the arsenic mitigation project. The residents in the mitigation villages seemed to be better informed about arsenic free surface water sources such as pond or river and green-coloured or deep tube-well as reliable arsenic-free water sources than the comparison villages. The rainwater as a safe source was significantly better known in the mitigation than comparison villages because of the installation of the rain water harvest in the area. On the other hand, the dug-wells were relatively better known in the comparison villages because of their availability in the area. Knowledge of at least two sources of arsenic-free water was significantly higher in the mitigation (41.8%) than the comparison (9.8%) villages ($p<0.01$). In the mitigation villages, a significant proportion also mentioned other safe water sources promoted by BRAC in some mitigation villages such as water purification plant and portable water filters. The purification plant seemed to be very popular in the area.

Identification and treatment of arsenic patients were important components of the mitigation project. The awareness campaign included the identification visible signs of arsenicosis on the body of the affected persons and the mode of transmission of arsenic diseases. The signs of wound on palms and body such as black spots on body and rustles on palms were widely known in the mitigation than the comparison villages. Overall, the mitigation project appeared to have significantly raised the

knowledge about the signs of arsenic contamination. Nearly 44% were able to mention at least two signs in the mitigation compared to only 7.8% in the comparison villages.

The misconception regarding the mode of transmission of arsenicosis was high in both the study villages. A significant proportion of the community people believed that arsenic disease had no cure. One arsenic patient, whose husband died from arsenic poisoning three years ago, complained that her neighbours tended to avoid her. She wanted to assure the community that arsenicosis is not a contagious disease. Although the awareness of transmission improved significantly in the mitigation (44.3%) than comparison (14.4%) villages, the finding indicates that the epidemiology of arsenic poisoning was not properly understood in the community.

Treatment of arsenic poisoning was in the process of development. The arsenic awareness campaign included the consumption of fresh vegetables with beta-carotene and arsenic-free fluid as the treatment of arsenic poisoning at the primary stage. While the community people were generally aware that seeking advice from the physicians or health workers would help treating arsenicosis, only few had knowledge of at least two measures of treatment. In the mitigation villages, 8.8% were able to correctly mention at least two measures compared to only 2.2% in the comparison villages.

Arsenic awareness campaign through mass media appeared to be effective in raising the knowledge level (Valente, Poppe and Merritt 1996) although the long-term behaviour change among the marginalised groups might be difficult by only education (Crane and Carswell 1992). The socio-economic and individual factors such as age, sex, education, media exposure and occupation had influences on the process.

Table 3 here

Influence of socio-demographic factors

The knowledge level regarding the safe water options (26.2%), signs of arsenicosis (26.4%) and the mode of transmission (29.8%) was modest while the awareness about the type of treatment was very poor (5.6%) (Table 3). The socio-demographic differentials in the knowledge of various aspects of arsenic issues were very wide. The younger (<30 years) generation appeared to be more knowledgeable about arsenic than the older people ($p<0.01$). The knowledge level had inverse association with age indicating that the people older were generally more resistant to accept newer ideas or less exposed to new values. The awareness level of the various issues of arsenic poisoning was relatively better among men than women although the gender gap in arsenic knowledge was not statistically significant. As expected, had significant ($p<0.01$) positive influence in raising the knowledge level of all issues of arsenic. Land ownership and family income source, the two economic status indicators, appeared to have positive association with arsenic knowledge ($p<0.01$). The

electronic media had important role in promoting arsenic awareness issues among its viewers. Data clearly suggest that exposure to media had positive and statistically significant association with the level of arsenic knowledge of all forms.

Table 4 here

Mitigation project and the level of awareness

The community health workers seemed to be very effective and well accepted in the community. One young woman remarked about the health worker, '*The tube-wells with green are good and we can drink from these but not from the red ones. Apa (community health worker) has explained to us.*' The role of the mitigation project in raising various measures of arsenic knowledge controlling for the effects of age, sex, education, land ownership, income source and media exposure is shown in Table 4. As have seen, the awareness of safe water options was 6.71 times higher in the mitigation than comparison villages adjusting for the influence of the confounding factors. The signs of arsenic were least covered in the national or other alternative media. As a result, the mitigation initiative raised knowledge about signs of arsenic poisoning to more than 9 times. The effects of arsenic mitigation project in raising the knowledge of the mode of transmission and the treatment was distinctly visible although the influence of other factors had also important bearing in promoting arsenic awareness. As discussed earlier, higher education had created the context of accepting newer ideas where exposure to electronic media had significantly promoted the knowledge level. Among others, age appeared to have negative influence on arsenic knowledge indicating that the mitigation project had difficulties in reaching the old. As one old man reacted to the potential danger of drinking arsenic contaminated water, '*We have been drinking this water for many years. What should we gain by remembering all those? How long should we expect to live!*' The project, however, was able to reach both women and men and, thus, significantly reduced the gender gap in arsenic knowledge. The economic status variables such as land ownership and income source had no effects at all.

Discussion

Both the government and UNICEF have been trying to promote the messages regarding arsenic contamination of drinking water throughout the country. The conventional information media, such as posters and billboards displayed at public places were not very effective in the traditional communities (Hadi 2001). As most of the people were illiterate in Bangladesh villages, the print media were not also appropriate. On the other hand, the electronic media, such as television, were not affordable to

most poor households. Also, a large section of the community were not able to clearly understand most of the messages because they could not relate the contents of the messages with their own experiences, thinking processes and reference points of their life. As a result, the audience most often played a passive role and paid little attention to those messages. The factors that could create interests, such as relevance and social appropriateness, were not adequately considered in designing the conventional arsenic awareness materials. The arsenic mitigation project of BRAC, on the other hand, paid more attention to the ability of the people to understand. The dissemination meetings with various social groups in the community during and after testing tube-wells by the health workers were informal, unstructured, participatory and, thus, were very effective in creating an interest about arsenic problems.

The highly charged message that 'drinking arsenic contaminated water is like drinking poison' has created sensation, interest and to some extent panic in the mitigation villages. This has been reflected in the demand of safe water in both the project and adjacent communities. As one woman observed, '... ... ... *We don't care about ourselves but our children must be safe*'. Testing tube-well for arsenic has also created curiosity, innovations and interest. The indigenous method of testing various water sources at less cost was promoted by some entrepreneurs outside the project. In many cases, those indigenous test results contradicted with each other and created confusions. While the reliability of those indigenous techniques was not examined, such innovations and contradictory test results, in fact, accelerated and intensified the public interest in the arsenic issues.

The water treatment plant, established in a study village for demonstration, became the symbol of campaign and an attraction for many people in the area. The plant not only provided arsenic-free drinking water in the communities but also attracted many visitors from other villages and played as a centre-piece of arsenic awareness campaign in the neighbourhood. Visiting the plant and the informal discussion about its features by the community people themselves in the first few months, propelled the community-level interpersonal communication and have created the context for promoting other arsenic related information such as signs, transmission and treatment of arsenicosis in the community.

One unique component of this project has been the focus on the poor and women – the two most disadvantaged groups in the society – who conventionally had limited access to information networks. This approach has not only reduced the gender and socio-economic inequality in arsenic awareness but also might have significantly reduced arsenic consumption since fetching water for drinking and other domestic use were generally the responsibility of women. The awareness level among the old was less than expected. The difficulties in reaching the older population should be identified and appropriate measures should be taken. The community forums where the older people routinely participate such as mosques could be used to disseminate relevant information regarding arsenic poisoning.

The project played an important role in reducing the misconceptions that had already created many problems. Some of the issues such as mode of transmission and the type of treatment were less understood than the safe water options or signs of arsenicosis. BRAC tried to develop a preventive approach by promoting the increased consumption of fresh vegetables, the use of arsenic free water and the existing health facilities in the area. As a result, the awareness to seek help from the health providers, drinking arsenic-free water and consuming fresh vegetables as curative measures increased in the project villages.

While the achievement in raising awareness was modest, the arsenic mitigation project played an important role in raising the confidence in preventing arsenic and was able to create an enable environment for change that justified the need of the continuation of such programme. As Chand Mia, a war veteran who had to operate his left arm for arsenic-infected gangrene, realised the need of health care for the arsenic poisoning, '*We need appropriate weapons to fight against arsenicosis as we fought during our war of liberation*' (Prothom Alo 2000). The community should be given the opportunity to decide to take preventive measures by themselves if the knowledge gained has to be sustained and effective in the long-run. One reason of success of the project has been the relevance with the context and personal experiences of the people of the community (Nair 1992).

There is a dominant view that the international public health tends to avoid the health problems of the poor communities. Non-existence of research on the socio-demographic aspects of arsenic poisoning has reinforced this accusation. The magnitude of arsenic problem in Bangladesh demands a series of systematic studies on various dimensions of this problem. Findings suggest that the community can be effectively mobilised to participate in the mitigation activities. The study concludes that the community-based intervention, if carefully designed and implemented, can make a difference in raising the knowledge of rural population. Although the awareness and modern practice of arsenic mitigation was very low among the poor, significant improvement is possible if appropriate measures are taken.

Table 3. Knowledge of arsenic issues by socio-demographic factors

Socio-demographic variable	Arsenic knowledge			
	Safe water options	Signs of arsenicosis	Mode of transmission	Type of treatment
All	26.2	26.4	29.8	5.6
Age (years)				
< 30	25.7	31.4	35.5	9.2
30 - 39	30.6	26.7	30.3	5.6
40 +	23.1	20.8	23.1	1.7
P	*<.01*	*<.01*	*<.01*	*<.01*
Sex				
Male	27.1	26.1	31.1	6.1
Female	25.3	26.6	28.5	5.0
P	*ns*	*ns*	*ns*	*ns*
Years of schooling				
No school	20.1	19.3	19.0	3.3
1 – 5	29.6	28.9	31.0	6.7
6 +	37.5	40.6	54.1	9.9
P	*<.01*	*<.01*	*<.01*	*<.01*
Land ownership (decimal)				
Landless	21.5	20.5	22.7	4.0
1 - 199	27.3	29.4	23.3	5.5
200 +	40.9	39.6	49.1	11.9
P	*<.01*	*<.01*	*<.01*	*<.01*
Family income source				
Selling labour	22.5	20.3	21.3	3.8
Other sources	30.1	32.8	38.8	7.5
P	*<.01*	*<.01*	*<.01*	*<.01*
Exposure to media				
Not exposed	21.6	23.0	24.9	4.8
Occasionally	28.8	28.0	29.6	5.3
Frequently	43.9	40.2	56.8	10.6
P	*<.01*	*<.01*	*<.01*	*<.05*

ns=not significant.

Table 4. Odds ratios for selected issues of arsenic knowledge

Study variable	Arsenic knowledge			
	Safe water options	Signs of arsenicosis	Mode of transmission	Type of treatment
Study area				
Comparison	1.00	1.00	1.00	1.00
Mitigation	6.71***	9.02***	4.55***	3.93***
Age (years)	0.99	0.98***	0.97***	0.94***
Sex				
Male	1.00	1.00	1.00	1.00
Female	0.94	1.01	0.90	0.71
Years of schooling				
No school	1.00	1.00	1.00	1.00
1 – 5	1.34	1.11	1.28	1.18
6 +	1.56**	1.49**	2.58***	1.11
Land ownership (decimal)	1.01	1.01	1.01	1.01
Income source				
Sale labour	1.00	1.00	1.00	1.00
Not sale labour	0.76	1.11	1.21	1.28
Exposure to media				
Not exposed	1.00	1.00	1.00	1.00
Occasional	1.48**	1.22	1.05	0.88
Frequent	2.80***	1.66**	2.52***	1.34
-- 2 Log likelihood	1213.2	1152.1	1239.9	464.3
Pseudo R squared	0.231	0.294	0.196	0.154

* p<0.10 ** p<0.05 *** p<0.01