Drinking no more arsenic: Switching water source through intensive awareness programme in rural Bangladesh

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Drinking no more arsenic: switching water source through intensive awareness programme in rural Bangladesh

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Abstract

The study assessed the effects of intensive awareness raising activities implemented from June 1999 to December 2001 among the arsenic exposed people to motivate towards safe water use. A total of 839 families those who used to drink arsenic contaminated water prior to intervention was selected randomly for the survey. Data revealed that 47.6% of the people switched from unsafe to safe water sources. Awareness on alternative safe water options played great role in motivating people towards safe water use. Rate of switching over was almost three times higher among the people those who were aware of alternative water options than those who were not. People with better education, high occupation and socio economic status showed the maximum rate of switching over towards safe water sources. People having the capacity to buy water options were seven times in number in changing their water source compared to those who have no capacity to buy. Integrated approach should be taken immediately to increase awareness on alternative water options, socio-economic status to increase their capacity to purchase water options.

Key words: *awareness development; switching over; water source; arsenic; Bangladesh*

Introduction

Arsenic, a metalloid in property, occurs in trace amounts in nature and significant levels can be found in polluted environment (Nriagu and Azcue 1990). 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 (BGS, 1998; Guha Mazumdar *et al.*, 1998). Human sensibility to the toxic effects of inorganic arsenic[1] [2]exposure is likely to vary based on genetics, metabolism, diet, health status, sex, and other possible factors, and risk of toxic effects is high among the children and people with poor nutritional status (NRC, 2000). Hundreds of millions of people have been exposed to arsenic contamination through drinking water in various countries of the world (Kamal ASM and Chowdhury AMS, 2002).

The problem of arsenic poisoning in the groundwater has been described as the biggest mass scale poisoning in its history. Estimates suggest that around 27% of the total tubewells installed over the years in the country have an arsenic concentration above the upper permissible limit of 50 µg per litre (DPHE/BGS/DFID, 2000; DoE, 1991). Currently 97% of the people in the country have been drinking well water (WHO, 2001; WHO, 2000) and population exposed to the arsenic poisoning is more than 25 million (Fazal *et al.*, 2001). More than 14,000 arsenicosis patients have been identified and the figure is going up day by day with the progress of patient survey programme (Ahmed, CM 2002). Apart from health, environmental and nutritional damage caused by arsenic poisoning its socio-economic consequences at the family and community level is also crucial.

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Provision of safe water for the arsenic exposed people in the rural areas has become a challenge for a number of reasons firstly, the water sources in the rural villages in Bangladesh are individual tubewells most of which are privately owned. The challenge therefore, is to provide individual household units whch seems not to be cost effective in monitoring water quality of these small units or organise people to supply them community based options which requires mass m otivation towards community based approach in this aspects. The another problem is lacking of a low-cost, available and wide-accepted water supply system. Well-switching could be a viable options for significantly reducing arsenic exposure in short term (van Geen A et al 2002). There are undoubtedly significant socio-economic barriers to well switching, since most well are privately owned (10). Convincing people towards a new safe water source becomes a great challenge since people once motivated to use well water over the decades in order to avoid water born microbial diseases. Information on role of awareness raising activities on switching over of the people from unsafe to safe water sources is not available in the country. Such a study, therefore, is expected to be helpful for the policy makers and programme implementers in designing and implementing programmes on water supply among the people in the arsenic affected areas of the country.

Materials and methods

Interventions of BRAC in the project area

BRAC (a non-profit development organization in Bangladesh) has been working on the arsenic problem of Bangladesh since 1996 when the problem drew the attention of the common people. As a continuation of its activities on safe water supply in the arsenic affected areas, BRAC conducted an action research project on community-based arsenic mitigation from June 1999 to December 2001 in the two sub-districts, Sonargaon and Jhikorgachha of Narayanganj and Jessore districts respectively, located in different location with high arsenic contamination in the country.

A combination of approaches were used in raising knowledge about arsenic contamination and the consequences of drinking arsenic water on human health. These included meetings with community leaders, workshops for health and other service providers, school teachers and religious leaders, meetings with villagers at the time of testing tubewells for arsenic, distribution of posters and leaflets at key public places, and the use of print and electronic media.

I the second phase, the people of these villages were informed of the status of arsenic poisoning in their locality. They were then solicited to choose a safe water option Village meetings, school meetings, and meetings with local elected bodies were used to inform on he arsenic crisis.

A workshop designed to train participants in the communication campaign was conducted in the two sub-districts. Representatives of different stackholders including block supervisors, tubewell mechanics, Union Parishad chairman, ward members, head teachers, imams health and family planning workers, ad NGO workers participated.

During the project period, 11 different types of option were demonstrated to test their technical viability and community acceptance (Chowdhury *et al.*, 2000). The potential safe water options and their relative merits and demerits, costs, maintenance and the selection of possible demonstration sites were also discussed among the villagers. The villagers were also encouraged to participate in sharing of cost for safe water options. People's own evaluation was used to assess the efficiency of these options in the community. Local masons were trained in construction and manufacture of the water options so that their expertise can be used to a maximum extent. Selected arsenicosis patients were provided with *Carocet* tablets (combination of vitamin A, C, and E) and salicylic acid as an ointment.

The assumption was made that all these approaches would lead to increased knowledge level that would help positive behavioural changes and motivate arsenic people towards safe drinking water use.

Data

The study was conducted in Sonargaon and Jhikorgachha sub-districts of Narayanganj and Jessore districts located in the middle and south-western part of the country respectively where BRAC had implemented action research project into community based arsenic mitigation.

Thirty-cluster sampling technique was used to select villages for the survey. A total of 60 villages, 30 from each of the sub-districts were selected randomly. Next, in each village 14 households were randomly selected from those households, which were using arsenic contaminated tubewell water (marked with red sign while screening in 1999) for drinking purposes. In this way, a total of 839 households was selected from the study areas. Since women in general, fetch water for drinking and cooking purposes in the rural areas of Bangladesh, adult housewives aged 15 and above of the selected households were interviewed to know their awareness level about alternative safe water options. Information on occupation and education of the household heads was also collected. The survey was conducted in February 2002.

Multivariate analysis

The study assessed the influence of several confounding factors like awareness of alternative safe water sources, education, occupation, socio-economic status and capacity to purchase safe water options on motivating people from arsenic unsafe to safe water sources. To assess the net effects of the mitigation project on switching of the exposed people towards safe water sources, multivariate analysis was done. Logistic analysis with the main effects only are shown in Table 3 for each five factors of switching to alternatives examined in this paper.

Results

Socio-demographic profile of the sample population

Table 1 shows the socio-demographic profile of the sample population. About 32% of the household-heads had never been to school. Most of the people (60%) were engaged in occupation of lower category like agriculture and labour. The rest of them were of high occupation mainly of service and business. From poverty self-assessment it appears that 35.6% were poor, 40% are average and the rest 24% were of high socio-economic status. Around 79% mentioned that they had their capacity to buy alternative water options.

Role of household factors and behaviour change

Table 2 shows the role of household factors and behaviour change on the rate of switching from unsafe to safe water sources. About 47.6% of the people changed their arsenic contaminated water sources to safe drinking water sources. Rate of switching was high (47.9%) among the people those who were aware of alternative safe water options than those who were not aware of. People with better education showed the maximum switching rate towards safe water use (55.1%) compared to those with no schooling (37%). High occupation and socio-economic status influenced maximum people (71% and 57% respectively) towards safe water use. About 56.5% of the people having capacity to buy alternative water options switched from unsafe to safe sources whereas only 14.1% of the people having no capacity to buy alternative water options moved to safe sources.

Role of socio-economic status

Table 3 shows that people aware of alternative water options changed their unsafe sources to safe water sources almost three times in number than those who were not aware of ($p<0.10$). Influence of education did not play significant role in changing behaviour of safe water use. High occupation played one and half times greater role in switching over towards safe water sources ($p<0.05$) and the same trend was observed in case of high socio-economic status compared to those who were poor ($p<0.10$).

Estimated probabilities of switching

Table 4 shows the estimated probabilities of switching to safe drinking water by the combination of predictors. The highest probability of switching towards safe water sources was shown by the people aware of alternative safe water options, poorly educated, high occupation, high socio-economic status and having capacity to buy water options. It was interesting to note that better education along with all other positive predictors showed lower rate of switching probability compared to the probability of the previous combination. This seems that level of education, from poor to better, played no significant difference in changing water sources. People not aware of alternative options, poorly educated, low occupation, high socio-economic status and having capacity to buy water options have only 0.34% probability whereas people with the same predictors except awareness of the alternative water options showed 0.60 rate of switching. This means that level of awareness about alternative safe water options played a major role in changing people's behaviour of safe water use.

Discussion

Bangladesh has been facing the disaster of arsenic poisoning in its groundwater which is the major source of drinking water of the country. The problem arised at the time while the country has been able to achieve the goal of safe water supply among nearly 97% of its population mostly through shallow wells. This success was achieved through promotion of shallow wells and motivation of the people towards use of well water rather than contaminated surface water sources across the country. The hardest part of the arsenic mitigation programmes, at this moment, seems to convince again the arsenic exposed people not to use water from the wells which are found to be contaminated. While communicating these people fro motivation on giving messages on arsenic issues, in most cases they become puzzled with these messages. Success in motivating the people towards arsenic safe water use, therefore, depends on the people's understanding as well as realizing the extent of the problem. In addition, availability of the alternative safe water options and the capacity to buy these option are also two other major vital factors in switching the arsenic exposed people from unsafe to safe water source.

Conclusion

The present study reveals that awareness of the people about alternative safe water options plays a great role in convincing people towards safe water use. A comprehensive approach on awareness raising about arsenic problem and motivate them towards safe water use is, therefore, needed to make people alert of the problem as well as to avert the human tragedy over the next several decades. In addition, appropriate measures should be taken to increase the capability of the people to buy safe water options. Both government and non-government service providers should come forward to make the water options available in the arsenic affected rural areas of the country. Micro-credit programme can also be introduced in the arsenic affected areas to increase people's capability to purchase safe water options.

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Table 1. Profile of the sample household

Study variable	Percent	N
Education		
No school	32.3	271
Poor	35.3	296
Better	32.4	272
Occupation		
Low (agri/labour)	60.1	504
High (service/business)	39.9	335
Socio-economic status		
Poor	35.6	299
Average	40.3	338
High	24.1	202
Capacity to buy		
Cannot	21.1	177
Can buy	78.9	662
N		839

Table 2. Proportion of households switched to safe drinking water by socio-economic factors

Study variable	Proportion of switching
All	47.6
Aware of alternative	
Unknown	28.6
Known	47.9
p-value	ns
Education	
No school	36.9
Poor	50.3
Better	55.1
p-value	<.01
Occupation	
Low (agri/labour)	41.3
High (service/business)	57.0
p-value	<.01
Socio-economic status	
Poor	38.1
Average	47.9
High	60.9
p-value	<.01
Capacity to buy	
Cannot	14.1
Can buy	56.5
p-value	<.01

ns=not significant

Table 3. Regression results for selected indicators of switching to safe water

Predictor variable	B	Odds ratios
Aware of alternatives		
Unknown		1.00
Known	1.082	2.95*
Education		
No school		1.00
Poor	0.291	1.34
Better	0.222	1.25
Occupation		
Low (agri/labour)		1.00
High (service/business)	0.405	1.50**
Socio-economic status		
Poor		1.00
Average	0.211	1.23
High	0.398	1.49*
Capacity to buy		
Cannot		1.00
Can buy	1.956	7.07***
Constant	-3.301	
-2 Log likelihood	1026.2	
Pseudo R squared	0.20	

*p<0.10, *p<0.05 and ***p<0.01

Table 4. **Estimated probabilities of switching to safe drinking water by the combination of predictors**

Combination of predictors	Estimated probabilities
1. Aware of alternative sources better educated, high occupation, high SES and had capacity to buy	0.68
2. Aware of alternative sources, poorly educated, high occupation, high SES and had capacity to buy	0.70
3. Aware of alternative sources, poorly educated, low occupation, high SES and had capacity to buy	0.60
4. Not aware of alternatives, poorly educated, low occupation, high SES and had capacity to buy	0.34
5. Not aware of alternatives, poorly educated low occupation poor SES and had no capacity to buy	0.05
6. Not aware of alternatives, not educated, low occupation, poor SES and had no capacity to buy	0.04

Note: Above probabilities are calculated from the estimated coefficients I Table 3 by using the following equation:

$p=\exp(a+\Sigma b_i x_i)/[1+\exp(a+\Sigma b_i x_i)]$