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Effect of Arsenic Mitigation Program on Practices of the Beneficiaries

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Abstract

The objective of the study was to assess the effect of arsenic mitigation program on practices of the beneficiaries regarding arsenic and related issues. The study was conducted in Bhanga and Matlab upazila under Faridpur and Chandpur districts, respectively with a sample size of 150 arsenic patients. Data were collected by using both qualitative and quantitative methods during January to March 2009. About four-fifths of the patient respondents (78%) showed medium to high changes in their practices regarding arsenic and the concerned issues. The differences of practices of the patient and non-patient respondents between pre and post participation in arsenic mitigation programs were highly significant and positive. It was also observed that education, farm size, organizational participation, contact with the sources of the information, annual family income and annual family expenditure had significant positive relationship with the change in practices of the patient respondents. Among different independent variables, education alone explained 58.00 percent of the total variations regarding practices of the respondents. Massive mass educational program emphasizing visual documentary could be useful in raising awareness towards arsenic mitigation practices among the respondents.

Keywords: *Arsenic, mitigation, practice, beneficiaries.*

Introduction

Ground water in majority of the wells in 60 out of 64 districts of Bangladesh, covering approximately 118,000 square kilometers (nearly 80% of the country), has concentrations of arsenic exceeding the World Health Organization's limit of 10 μg/L, and only 30% of ground water contains arsenic at levels below 50 μg/L required for the Bangladesh drinking-water standard (Karim, 2000) and Ahmed, 2001). According to some experts, arsenic poisoning in Bangladesh is the greatest mass poisoning, the world has ever witnessed (Alauddin, 2003).

According to some studies conducted by various national and international organizations including UNICEF and DFID, about 35 million Bangladeshi citizens, mostly poor, are currently being slowly poisoned from drinking arsenic contaminated water and some 80 millions are under potential risk. More than 14,000 people have already been identified as suffering from arsenic related diseases. According to the report, thousands more will join them in the years ahead if urgent steps are not taken immediately (Rahman, 2003).

Different arsenic mitigation programs (AMP) have been undertaken by the various Government and Non-government organizations considering the severity of arsenic contamination in drinking water, (Anonymous, 2006). There are so far 25 organizations engaged in awareness raising in different parts of the arsenic contaminated areas at local and national levels working through a total of 60 projects and programs. The primary focuses of those mitigation efforts in Bangladesh has been on the screening of arsenic contaminated tube-wells,

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identification of patient, treatment of the patients, provision of alternative water sources and increase the use of arsenic mitigation practices by the affected people (Anonymous, 2005). It is, therefore, necessary to document the changes in related practices of the arsenic mitigation options by the beneficiaries for smooth operation of future programs regarding arsenic mitigation. This initiated the researchers to raise some relevant questions as follows: what is the status of arsenic mitigation options that are being practiced by the beneficiaries? And what are the relationships between the selected characteristics of the respondents and their changes in practice level? Considering the above circumstances, an attempt was made to undertake the present study to investigate the change in practice level of the respondents due to their involvement in the arsenic mitigation program; and to find out the relationship between the selected characteristics of the respondents and the changes in their practice level due to participation in those activities.

Methodology

Faridpur and Chandpur districts were identified as the most devastating occurrence of arsenic contamination in ground water (Anonymous, 2004). Therefore, Bhanga and Matlab upazilas under the above two districts were purposively selected as the locale of the present study. The arsenic patients of the arsenic mitigation programs (UNICEF/DPHE fifteen upazila arsenic mitigation program and Arsenic in tube-well water and health consequences program) of the selected areas were considered as the target population of the present study. For smooth execution of sampling procedure the lists of the target population were collected from the authority of upazila Sadar hospitals of Bhanga and Matlab. The number of sampling population was 504 in Bhanga upazila and 250 in Matlab upazila that turned into 754 as a whole. One hundred and fifty arsenic patients were selected as sample applying proportionate random technique. Another 50 non-patients were also selected for validation of results. Quantitative data were collected during January to March 2009 using a pre-designed interview schedule. Besides, Focus Group Discussion (FGD) and Direct Observation were used to collect qualitative data for triangulation of results. Spearmen correlation of coefficients was used to explore relationships between selected characteristics of the respondents and their practice change. Regression was employed in order to determine individual contribution of the selected characteristics on practice change.

Measurement of selected socio-demographic characteristics of the respondents was completed by using standard method. Practices of the respondents regarding arsenic removal technologies, alternate option of safe drinking water, intake of nutritious fruits and vegetables, receiving advice from the doctor, rendering advice to the neighbors, sharing of arsenic related information and collecting safe drinking water by the male members of the households were assessed by using a 10-item scale. The scale included different item statements of the above mentioned areas which were obtained from the judges' rating and results of pre-test following the same procedure as those of attitudinal items. A 5-point rating scale was constructed ranging from 'frequently practice', 'moderately practice', 'occasionally practice' 'rarely practice' and 'not at all practice'. Weightage of '4', '3', '2' '1' and '0' were assigned for

'frequently practice', 'moderately practice', 'occasionally practice' 'rarely practice' and 'not at all practice' respectively. The total practice scores of a respondent both for before and after arsenic mitigation program implementation were obtained by summing his/her scores for all the item statements. Thus, total practice scores of a respondent could range from 0 to 40 where, '0' indicating no practice at all and '40' indicating frequent practice i.e., high level practice of the respondents in the aforesaid areas for both pre and post arsenic mitigation program implementation. The mean practice value differences between pre and post arsenic mitigation program implementation were tested by administering t-test.

Measurement of practice of the patient and non-patient respondents about arsenic and related issues was computed for both pre and post involvement period with the arsenic mitigation programs. The practice change was considered as the practice score difference between pre and post situations of the programs.

Findings and Discussion

Practice of the patient respondents before their participation in AMPs

The practice of the patient respondents regarding arsenic and related issues before their involvement with arsenic mitigation programs varied from 0-25 against the feasible range of 0-40, with an average of 5.84 (Table 1).

Table 1 Distribution of the patient respondents according to their level of practice regarding arsenic and related issues

Categories	Respondents						Observed "t" value with df 149
	Before involvement with AMP			After involvement with AMP			
	No.	%	Mean	No.	%	Mean	
Low (up to 10)	130	87	5.84	5	3	19.99	32.70**
Medium (11-15)	17	11		38	25		
High (16 and above)	3	2		107	72		
Total	150	100		150	100		

Findings presented in Table 1 show that 87 percent of the patient respondents fell under the low practice category, while a poor portion of them (11%) were under medium and only very negligible portion of them (2%) were under high practice category. Therefore, very pre-pondering mass of the patient respondents (98%) occupied low to medium practice categories prior to their association with the arsenic mitigation programs.

The patient respondents participated in the mitigation programs and learnt new desirable practices in order to be free from arsenic infection. The practice of the patient respondents regarding arsenic and related issues were calculated after their participation in arsenic mitigation programs and pertinent scores ranged from 1-40 against the potential range of 0-40, with an average of 19.99. Results presented in the same Table also demonstrate that 72 percent of the patient respondents belonged to the high practice category, 25 percent in medium category while only 3 percent were found in low practice category. It is crystal clear from

Table 1 that almost all the patient respondents (97%) fell under medium to high practice categories and only very poor segment of them (3%) were found in low practice category after their involvement with the arsenic mitigation programs. The difference of practices between before and after involvement in the arsenic mitigation program was highly significant. This remarkable level of practice in arsenic mitigation options might be due to their active participation in AMPs.

Change in practice of the patient respondents

The attachment of the patient respondents with the mitigation programs exerted appreciable change in their practice so that they could be freed from arsenic infection. The practice change was computed and found that the practice score of the patient respondents regarding arsenic and pertinent issues varied from 0-37 against the possible range of 0-40, with an average of 17.33 (Figure 1). Findings in the Figure also disclose that 52 percent of the patient respondents had experienced high change in their practice, 26 percent moderate change, whereas 22 percent had low change in their practice related to arsenic mitigation measure due to their participation in the mitigation programs.

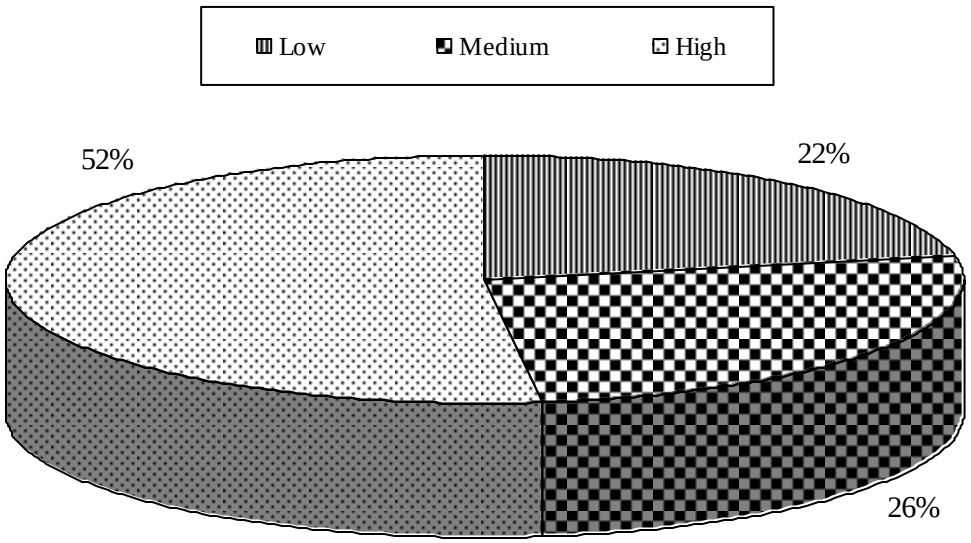

Figure 1 Distribution of the patient respondents according to their change in practice regarding arsenic and related issues

Thus, an overwhelming majority of the patient respondents (78%) experienced medium to high practice change regarding arsenic and related issues due to their association with AMPs. Rosenboom (2004) in a study reported that the practice of the arsenic mitigation options increased from 2-43% by the arsenic mitigation program's beneficiaries due to their involvement in the program.

Practice of the non-patient respondents

Similar to the patient respondents, practice of non-patient respondents was also measured before their participation in the arsenic mitigation programs. And the practice score of the non-patient respondents regarding arsenic and related issues before their participation in arsenic mitigation programs varied from 0-28 against the probable range of 0-40, with an average of 5.36. Presented results reveal that 96 percent of the non-patient respondents were under the low practice category; while a poor mass of them (4%) were in high practice category before their involvement in arsenic mitigation programs (Table 2).

Table 2 Practice differences of the non-patient respondents between 'pre and post' involvement with arsenic mitigation programs

Category	Before involvement with the AMP			After being involved with the AMP			Observed "t" value with df 49
	Number	Percent	Mean	Number	Percent	Mean	
Low (0-10)	48	96	5.36	4	8	26.46	20.34**
Medium (10-15)	-	-		18	36		
High (16 and above)	2	4		28	56		
Total	50	100		50	100		

It is remarkable that none of the non-patient respondents belonged to medium practice category. But in case of patient respondents 87 percent respondents fell under low practice category during the period (Table 1). The practice score of the non-patient respondents on the subject of arsenic and concerned issues after their partaking in arsenic mitigation programs varied from 9-40 against the achievable range of 0-40, with an average of 26.46. Results furnished in Table 2 confirm that 56 percent of the non-patient respondents were identified under the high practice category; while 36 of them were in medium level practice and only very poor mass of them (8%) had low practice subsequent to their participation in arsenic mitigation programs. Therefore, a much greater part of the non-patient respondents (92%) showed medium to high level practice in the aforesaid subject after being involved with mitigation programs which were exactly similar like those of patient respondents during the same time (Table 1). This might be the result of their utmost effort and anxieties for avoiding arsenic contamination and, therefore, due to their active participation in the arsenic mitigation programs.

Change in practice of the non-patient respondents

Generally speaking, a person is intelligent enough who changes his practice and behavior in case of need. Again, it is said that necessity is the mother of invention. The practice change of the non-patient respondents regarding arsenic and related issues was observed which varied from 5-36 against the possible range of 0-40, with an average of 21.10 and standard deviation of 7.35. Distribution pattern of change of the said respondents is shown in Figure 2.

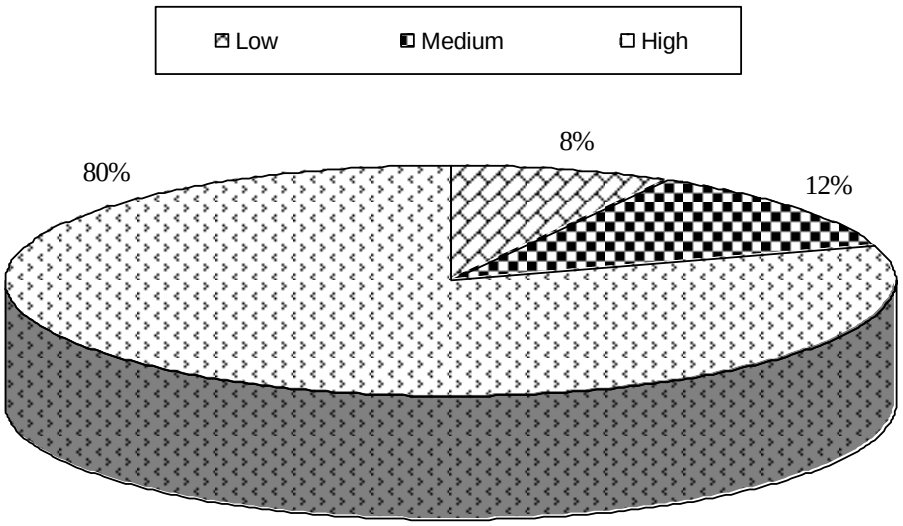

Figure 2 Distribution of the non-patient respondents according to change in their practice regarding arsenic and related issues

Information displayed in Figure 2 reveal that 80 percent of the non-patient respondents consisted of high practice change category, while only 12 percent medium and 8 percent of them belonged to low practice change categories. Thus, a large mass of the non-patient respondents (92%) demonstrated medium to high level practice change regarding arsenic and pertinent issues.

The typical variation in practice of the patient respondents between pre and post attachment with the arsenic mitigation programs was tested by employing the following null hypothesis: "There is no change in practice of the patient respondents between pre and post involvement with the arsenic mitigation programs". The computed t-value was 33.70, which was highly significant. The null hypothesis was rejected on the basis of the above findings. Therefore, it can be concluded that practice of the patient respondents changed significantly after their participation in the arsenic mitigation programs. The results were identical between the locations. In this connection it was also viewed that the patient respondents gained substantial knowledge about arsenic and related issues from the arsenic mitigation programs and changed their practice regarding the issues which led to change in their practice concerned with the use of arsenic free water and imparting advice to family members, neighbors and relatives related to arsenic and pertinent issues. The non-patient respondents showed slightly higher change in practice than those of patient respondents.

Jakariya *et al.* (2007) in a study observed that acceptability of the distributed arsenic mitigation practices were not encouraging; less than 2% of the provided options were found to be in operation. However, two new approaches emerged from people's initiatives, which were making rapid and positive contributions to safe water coverage.

Relationship between practice change and the selected characteristics

Educational qualification, farm size, number of training received, organizational participation, contact with the sources of information, annual family income and annual family expenditure of the patient respondents showed significant positive relationship with their change in practice (Table 3).

Table 3 Relationship between selected characteristics of the patient respondents and change in their practice

Selected characteristics of the respondents	Change in practice
Age	0.021
Education	0.763**
Family size	0.035
Farm size	0.231**
Organizational participation	0.295**
Contact with the sources of information	0.438**
Annual family income	0.228**
Annual family expenditure	0.169*

*Significant at 5% level, **Significant at 1% level

The values of correlation of coefficient (r values) illustrate that with the raise in educational qualification, farm size, number of training received, organizational participation, contact with the sources of information, annual family income and annual family expenditure of the patient respondents there was an addition in their practice regarding arsenic and concerned subject matter.

Therefore, it was concluded that the higher is the educational qualification, farm size; number of training received, organizational participation, contact with the sources of information, annual family income and expenditure of the patient respondents, the greater is the change in their knowledge and practice leading to additional change regarding arsenic and related issues. This analysis concurs with those of Dasgupta (2004) and McConnel and Rosado (2000) who found that higher-educated individuals had higher likelihood of averting arsenic exposure. Laughland *et al.* (1996) also found that averting actions of polluted water were positively related to the perception of convenience of averting practices.

Likewise knowledge and practice, it is also assumed that all the selected characteristics of the patient respondents might have contribution on their change in practice. To find out the actual contribution on the change in practice, multiple linear regressions was used. Findings presented in Table 4 explain that multiple R and R^2 values in the full model regression were 0.768 and 0.590, respectively. It denotes that the seven selected characteristics explained 59 percent of total variation of the change in practice about arsenic and concerned subject, out of which only education showed significant positive contribution in the situation. The roles of the other variables were insignificant.

From Table 4, it was also found that farm size, annual family income and annual family expenditure demonstrated positive trend whereas number of training received, organizational participation and contact with the sources of information indicated negative trend.

Table 4 Multiple linear regression analysis showing contribution of the selected characteristics on practice change of the patient respondents

Selected characteristics	Un-standar-dized coeffi-cients (β)	Standar-dized coeffi-cients (β)	t-value
Education	1.086	.805	11.03**
Farm size	.001	.016	.218
Number of training received	-.408	-.056	-.971
Organizational participation	-.006	-.007	-.110
Contact with the sources of information	-.051	-.059	-.836
Annual family income	.002	.037	.435
Annual family expenditure	.002	.020	.234
Constant	9.454		
R^2	.590		
Multiple R	.768		

Findings of stepwise regression analysis showed that educational qualification of the patient respondents only clarifies the highest part (58.30%) of the total variations in practice of the patient respondents about arsenic and related subject matter. The variations caused by the other variables were insignificant.

Direct observation

A number of direct observations were made in the two locations under study. Information presented in Box 1 indicates some important points, which should be taken into account in formulating any strategy focusing on arsenic issues for further improvement. From the observations in general, it became visible that respondents in both locations changed their practice to some extent. Most of them are maintaining continuous use of alternate water options, try to manage vegetables in their meals, develop culture of exchanging arsenic related information and eager to pay for safe water options and alternate water sources.

Box 1. Recorded direct observation items

General observation:

- Arsenic infection occurs irrespective of male and female
- People are aware of arsenic and related complicacy
- They behave gently with arsenic patients
- Arsenic patients claim that they do not have medicine from upazila hospital
- Most of them hardly manage to install arsenic free tube-well
- No significant initiatives are undertaken by local leaders in arsenic mitigation
- During rainy season, people don't have opportunity to produce vegetable as both of the locations are flood prone

Observations related to practice:

- There is profuse use of alternate water options rather than arsenic removal options
- Villagers try to manage vegetables for their every meal
- During the rainy season, low land and high market price discourage using available vegetables
- There is culture of exchanging arsenic related information among the villagers
- They are ready to spend for arsenic free water

Focus group discussion (FGD)

To assess effect of arsenic mitigation programs some of the key informants namely school teacher, imam (religious leader), local leaders, NGO workers and health workers were also interviewed in both of the locales. Findings presented below indicate that there was high change in knowledge of the programs beneficiaries due to attending meeting with the programs' personnel, frequent contact with the health worker, reading leaflets and posters etc. in connection with arsenic and related issues. Based on FGDs (n= 15 +15 =30) the following reasons were identified for medium to high level change in practice of the respondents regarding arsenic and related issues:

- Participating in demonstration meeting
- Contacting with innovative neighbors
- Receiving advice from program personnel
- Getting in touch with health worker
- Participation in nutritional campaign
- Visit to demonstration plots
- Installation of arsenic free tube-well
- Distribution of filter, alum etc.

Therefore, the respondents achieved medium to high level change in their practice level as they participate in demonstration meeting, contact with innovative neighbors, receive advice from programs' personnel, get in touch with health workers, participate in nutritional campaign, visit to homestead vegetables and fruit demonstrations, installation of arsenic free tube-well and distribution of filter, alum etc.

Conclusions

Seventy eight percent of the patient respondents encountered medium to high changes in their practice regarding arsenic and the concerned issues. The practice differences of the patient respondents between pre and post arsenic mitigation programs situations were positively significant. The findings between the locations and patient-non- patient respondents were identical. Hence, it could be concluded that the arsenic mitigation programs have generated changes in practice of the programs' beneficiaries regarding arsenic and related issues. The step wise regression analysis showed that education alone explained 58.30 percent of the total variations in practice of the respondents. Therefore, it was concluded that education is the key factor in changing practice of the beneficiaries. Therefore, the DPHE and Upazila Health and Family Planning Department should undertake massive mass educational program among the respondents emphasizing visual documentary in raising awareness leading to sustainable adoption of the arsenic mitigation practices.

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