Extended Abstract

Tube-wells as a Community Health Intervention: Can They be Effective in Bangladesh?

Introduction

Bangladesh is located in the flood-prone delta of the Bay of Bengal. The rivers Meghna, Padma, Jamuna, and Karnafuli and their branches and canals criss-cross the country. Tropical monsoon rains drench the land and the rivers. The onrush of rainwater in summer sometimes overflows riverbanks to flood low and outlying areas. Water from the rivers and canals falls into watersheds including ponds (pukur), canals (khaal), marshland/swampland (beel), and extensive marshes (haorh). In almost every part of the country, there are surface water sources close to most of the households. Traditionally, these were the sources of water for household use including drinking, food preparation, dish washing, laundry and bathing. Over two decades ago concern with the incidence of water borne disease prompted the United Nations Children Fund (UNICEF) to launch a campaign to provide clean water through hand pumped tube-wells to all village communities in Bangladesh. After providing access to tube-wells for more than 97 percent of Bangladeshis, it was found that there are high levels of arsenic in the ground water in many parts of the country, with a substanital percent of wells providing water with dangerously high levels of arsenic, even though coliform levels are low. In contrast, arsenic levels are low in surface water while faecal coliform levels are high. This creates a dilemma for health policy and programs. Although it is possible to filter arsenic from tube-well water, it is not feasible as 36 percent of Bangladeshis live under the poverty line, defined as 2122 kcal of food intake per day (Ravallion & Sen, 1994; Hossain & Sen, 1992; Binayak Sen, 1995). This leads to questions related to current policy? Should people continue to be encouraged to use tube-wells as the exclusive source of household water? Is it likely that they will? What are health consequences of current water use patterns?

The study

The purpose of this study is to examine the factors influencing the use of tube-wells, a common health intervention in Bangladesh, compared to use of other water sources, and the implications of specific sources for health. The '1998 Population, Environment, and Poverty' study of eight villages in rural Bangladesh is used for this research. Survey data, focus group interviews and water samples of tube-well and pond water are used to explore the research questions.

For the survey, initially, four rural thanas (sub-district = US county) were purposively selected based on high population density and representation of different agro-ecological zones (AEZ) of Bangladesh. After that, from each thana, two villages were selected randomly were selected randomly for the study. From each village 65 households were randomly selected and a total of 520 households/household heads were selected for interview. Of the interviewees, 95 percent are male. In addition, forty surface water samples (five from each village) were collected; eight FGDs and eight ethnographic surveys (one in each study village) were conducted as part of the data collection. The lab samples of pond water established levels of faecal coliform (fc), lab samples of tube-well water established levels of arsenic, and data from focus groups

and ethnographic surveys were used as aids in understanding the health behavior and culture of the villagers. For example, in the focus group discussions it became clear that slab latrines are not really sanitary since they are not water sealed. The data were collected over six months beginning in July, 1998. Chi-square and logistic regression analyses are the statistical methods used.

Study Results

The source of water used is reflected in the health experiences of household members. Of the 520 households in the study, 97 percent reported using tube-wells as the primary source of drinking water. Just 48 percent use tube-wells exclusively for households' tasks. The laboratory test results of 40 tube-well water samples show that more than fifty percent (five of eight villages) of the study areas are badly affected by arsenic contamination. More than seven out of 10 people in Chandina thana and about half (46%) of Sonagazi are badly affected by arsenic as a result, and the incidence of skin disease in these thanas is higher than in other thanas (see Table 1).

Table 1: Percent of Households Reporting Skin Disease by Level of Arsenic in Tube-well Water ((µ g/L)

Thana (sub-district)	Level of arsenic (µ g/L)*	Skin Disease (%)		Total
		Yes	No	
Sonagazi	3.67-6.42	46 (59)	54 (71)	100 (130)
Chandina	6.37-6.46	72 (94)	28 (36)	100 (130)
Modhupur	0.03-0.28	38 (49)	62 (81)	100 (130)
Jamalpur	00.0-10.96	27 (35)	73 (95)	100 (130)

** WHO standard* 0.05 mg/l; *Chi-square value = 58 .946; df = 1; P = .000*

While just about 3 percent of households use sources other than tube-wells for drinking water, 52 percent use some type of surface water such as a pond for other household tasks including dish-washing and bathing. Tests of the 40 pond water samples show that all of them are contaminated with faecal coliform (fc); the level of contamination is beyond the permissible limit (standard for fc in drinking water is "0"). The contamination varies by villages and it ranges from 3 cfu/ml to 360 cfu/ml. As shown in Table 2 more than half (52%) of households with high levels of fc (82-360 cfu/ml) report diarrheal disease, compared to 39 percent of those with lower levels of fc (3-52 cfu/ml).

Table 2: Percent of Households Reporting Diarrhea by Level of FC

Level of Faecal Coliform (cfu/ml)	Diarrhea (%)		Total
	Yes	No	
Low (3-52)	39 (72)	61 (115)	100 (187)
Medium (82-360)	52 (174)	48 (159)	100 (333)
Total	47 (246)	53 (274)	100 (520)

Chi-square value = 9 .082; df = 1; P = .003

The bivariate results (Chi-square 12.938; df 2; p .002) indicate that there is a significant association between diarheal disease and level of faecal colifform.

Village-level Effects

Table 3: Percent of Households Reporting Skin Disease and Diarrhea by Village

Village	N	Skin disease (%)		Diarrhea (%)	
		Yes	No	Yes	No
Badhadia	65	46 (30)	53 (35)	46 (30)	54 (35)
Basantapur	65	72 (47)	28 (18)	65 (42)	35 (23)
Chak Amuata	65	40 (26)	60 (39)	48 (31)	52 (34)
Charpara	65	22 (14)	78 (51)	37 (24)	63 (41)
Kamar Khola	65	72 (47)	28 (18)	68 (44)	32 (21)
Mirzapur	65	45 (29)	55 (36)	45 (29)	55 (36)
Radha Nagar	65	36 (23)	64 (41)	50 (32)	50 (32)
Sharifpur	65	32 (21)	68 (45)	21 (14)	79 (52)
Total	520	46 (237)	54 (283)	47 (246)	53 (274)

Chi-square value = 60. 874; df = 7;P=.000

The bivarate results in Table 3 indicate that there is a significant association among skin disease and diarrhea with village (Chi-square 60.874; df 7). Villages in which a large percent of households report skin disease tend to be households in which a large percent of households also report diarrhea. This is true in spite of the variation in the extent to which households use water sources alternative to tube-wells.

Multivariate analysis

Using logistic regression techniques, the multivariate analysis will examine the Impacts of household characteristics, household water sources and village with household experience with disease.

Culture costs life: Village health culture

Culturally, pond water is considered as god gifted and always preferred than less contaminated tube-well water for washing kitchen utensils, cooking, bathing, and other daily use by the villagers. Data shows all pond water is contaminated and is contributing to experience with diarrhea. Unfortunately, we do not know the age of the household members experiencing diarrhea, but we suspect much of it is among children., which can be deadly. Village residence has more of an influence than education and occupation in using pond water.

Conclusion

The study shows that sample Bangladeshi households accept tube-wells as a community health intervention and more than 97 percent have access to tube-well for safe water. However, the presence of arsenic in ground water discourages them from using the only source of water that is free from contamination by coliform bacteria. As a result, it reinforces the use of traditional water sources such as ponds. The results show water in all ponds is contaminated with faecal coliform that is vulnerable for diarrheal disease. Currents initiative taken at public and private sector are not enough to ensure safe water to the villagers. In addition to technical and financial help from the international community, education that will address these traditional practices is necessary.