Mothers' Personal and Domestic Hygiene and Diarrhoea Incidence in Young Children in Rural Bangladesh

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This study examines the effect of maternal personal and domestic hygiene on the incidence of diarrhoea in children aged 6–23 months from rural areas around Teknaf, Bangladesh. The intervention area received augmented water supply through handpumps and health education while the control area received no project inputs. From July 1980 to June 1983, diarrhoea incidence was recorded weekly while mothers' personal and domestic hygiene was observed yearly. Annual incidence of diarrhoea in 314 children from the intervention area and 309 children from the control area was analysed in relation to maternal personal and domestic hygiene, controlling for education and occupation of household head and household size. Results show that, in both areas, use of handpump water for drinking and washing, removal of child's faeces from the yard, and maternal handwashing before handling food and after defaecation of self and child, observed together, decreased yearly diarrhoea incidence in children by more than 40% compared to children living in households where none or only one of these practices was observed.

Acute diarrhoea is common in young children, particularly those between six months and two years old.[1] Most is due to poor personal hygiene and an insanitary environment causing contamination of weaning foods and fluids. However, the introduction of improved water supply and excreta disposal facilities in highly contaminated communities has often not resulted in reduction of diarrhoeal diseases.[2-6] Most studies which have dealt with the relationship between environmental sanitation and the risk of diarrhoea assumed that presence of the facilities was synonymous with their use,[3,6-11] and did not take account of hygiene-related behaviour.[12-16] Moreover, impact studies have mainly concentrated on the effect of sanitary facilities without taking into account information on personal hygiene that may influence childhood diarrhoea,[4,7-10] or relied on assessment of the impact at community rather than at the individual level.[10] Studies on hygiene associated with the use of water, especially those related to hand washing with soap have shown its impact in reducing diarrhoea rates by 14–48%, however, the impact of the programme was assessed by a simple one-to-one community comparison.[17-19]

This study attempts to examine the effectiveness of use of handpump water for drinking and washing, maternal handwashing using other procedures such as rinsing the hands before serving food and rubbing the hand in ash

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or washing with soap after defaecation, and removal of child's faeces from the yard soon after defaecation, in reducing diarrhoea incidence in young children in a rural area of Bangladesh. These interventions are important because they are cheap and relatively simple to impliment in countries like Bangladesh where poverty and illiteracy abound.

METHODS

The data for this study were collected by the Teknaf Water and Sanitation Intervention Project of the International Centre for Diarrhoeal Disease Research, Bangladesh in the period July 1980–June 1983. Teknaf is a peninsula in the remote south eastern tip of Bangladesh with a sub-tropical climate. The main occupations are traditional agriculture and fishing in the nearby Naf river and the Bay of Bengal. Most houses have leaf roofs and earth floors. The principal water sources are handpumps for drinking and ditches (usually shallow hand-dug with no casing and covers) for washing and cooking. Women stay at home doing housework and have no formal education. Children are introduced to supplementary food around six months of age.

Three sub-units (paras) of the village, Shahpuridwip, population 2173 (the intervention area), were provided with handpumps in August-September 1980 with a ratio of one handpump to 4–6 households to improve access to clean water. To reinforce its use and to promote hygiene, especially to mothers and other female household members, health education was given continuously

in two-month blocks by female health visitors through home visits, group discussion and demonstrations during the study period. Mothers and other female household members were made aware of the danger of diarrhoeal diseases as well as the role that clean water and hygiene may play in preventing them. The main objectives of health education were promotion of consistent and exclusive use of handpump water, improvement of water handling and storage practices, disposal of the child's faeces soon after defaecation, washing hands before handling food and rubbing hands in ash or using soap after defaecation.

Two adjacent paras of the same village, population 2067, receiving no project inputs served as the control area. These two populations were comparable in terms of education of household head, household size and sanitation conditions before the study. Immediately after installation, the number of functioning handpumps in the intervention area was three times larger than in the control area. Over the years of the project some households in the control area purchased their own handpumps privately. These were used only by that family. In the intervention area handpumps were available for everyone to use. It is important to stress that the analysis focuses on the individual rather than the community. Free outpatient treatment of diarrhoea was provided in both areas by a clinic in the village.

At the beginning of the study a population census was carried out. Information on education and occupation of individuals and household heads was collected. Education (overall, education is low, mostly one year's schooling with females predominantly illiterate) and occupation of household head have been considered as indicative of socioeconomic status of the household. Occupation was categorized in two groups, the higher included owners of farm land, fishing equipment, businessmen, tradesmen, craftsmen or servicemen, the lower group consisted of daily waged farm or fishing labourers, the unemployed or housewives.

Trained male Health Assistants (HA) accompanied by female community workers visited the households in the intervention and control areas once a week to record diarrhoea incidences experienced by the household members since their previous visit. Diarrhoea was defined as three or more loose motions in a 24-hour period whether or not blood was present. An episode was considered new if there was an interval of at least 48 hours between symptoms. The HAs were rotated every month among areas to minimize bias. Information on maternal personal and domestic hygiene was collected during the dry seasons (February-March) of 1981–83. Mother's personal hygiene referred mainly to rinsing hands before serving food and rubbing hands in ash or

mud (mainly ash was used in the intervention area and mud in the control area) after cleaning the anus of self and her child, while domestic hygiene referred to use of handpump water for household use and absence of faeces (on visual inspection) in the yard.

Children in this study were selected if they were six to 23 months old and had more than six months of observation in any given year. If the household had more than one such child, then only one child (the last) was considered for this analysis. Twenty-seven children from the intervention area and 50 from the control area were excluded from the analysis for this reason. However, their diarrhoea incidence was not significantly different from that of the children studied. In the intervention area 23 child-periods were not included in the analysis due to short observation and 31 due to missing values. In the control area 18 and 37 were excluded respectively. Totals of 389 (8 observed less than 12 months) child-years accumulated by 314 children in the intervention area and 390 (9 observed less than 12 months) child-years of 309 children in the control area were considered in the analysis.

DATA ANALYSIS

Census information on household size, education and occupation of the head of household and data obtained on maternal personal and domestic hygiene were linked with diarrhoea incidences occurring in the corresponding study year (July-June). Diarrhoea episodes per child-year for different groups of maternal personal and domestic hygiene practices and different socioeconomic characteristics were compared within the areas using the Z-statistic, under the null hypothesis of no exposure disease association. The net effects of the considered hygiene factors on having none or one episode (a dichotomous variable with 1 for none or one episode for 0 for more than one episode) in a one-year period after controlling for socioeconomic status of the household have been estimated and tested by multiple logistic regression analysis. The independent variables except for household size were dummy coded. The goodness-of-fit of the model was tested by Cg statistic.[20]

RESULTS

Overall, in 10.5% of total child-years there was no diarrhoea, whereas in 11.0% of child-years there were eight or more diarrhoea episodes. Table 1 presents diarrhoeal incidence per child-year by maternal personal and domestic hygiene practices in the intervention and control areas. On average, a child in the intervention area had 3.4 diarrhoea episodes in a year while a child in the control area had 4.1 episodes. The difference was statistically significant (P<0.01).

TABLE 1   *Diarrhoea incidence per child-year by mother's personal and domestic hygiene and area*

Risk variable	Intervention area			Control area		
	N	Mean	SD	N	Mean	SD
All	389	3.4	2.8	390	4.1	3.3***
1. Source of washing water:						
a) Handpump	331	3.4	2.8	183	3.6	3.0**
b) Ditch/ring-well	58	3.7	2.9	207	4.5	3.5
2. Faeces in the yard:						
a) No visible faeces	251	3.0	2.5**	216	3.8	3.1
b) Visible faeces	138	4.1	3.1	174	4.4	3.4
3. Handwash before serving food:						
a) Rinse hands	272	3.1	2.6**	226	3.6	3.1**
b) Wash finger	117	4.2	3.0	164	4.6	3.4
4. Handwash after defaecation:						
a) Use ash/mud	215	3.0	2.6**	108	3.9	3.6
b) Use water only	174	4.0	2.9	282	4.1	3.2

N = number of child-years, SD = standard deviation
* P<0.05, ** P<0.01 ('a' compared with 'b')
*** P<0.01 (intervention area versus control area).

Within the intervention area, diarrhoea incidence was higher for those children whose mother's personal hygiene and household environment were relatively poor than for those in opposite groups. In the control area, similar hygiene practices were observed but less often. Diarrhoea incidence was higher for children in households where handpump water was not used for washing and where the mother's hands were not usually clean (washed fingers only) at the time of handling food. However, diarrhoea incidence was similar irrespective of presence or absence of faeces in the yard and maternal type of handwashing after defaecation of self and child.

However, the observed differences in diarrhoea rates between exposure and non-exposure categories of maternal personal and domestic hygiene practices could not be attributed to the effect of a particular hygiene practice. It was found that mothers who observed one practice were more likely to observe some of the others as well. To test which of the particular practices were significantly associated with reduction in diarrhoea incidence we divided children into groups where mothers observed, only one particular practice, combination of two or three practices and all four. In neither area did the incidence of diarrhoea differ significantly between groups observing the same number of practices, even when combinations varied. However, diarrhoea rates were found to vary significantly if the number of hygiene practices changed (Table 2). Diarrhoea incidences were 46% and 43% lower for children in households where four hygienic practices were observed than in those

TABLE 2   *Diarrhoea incidence per child-year by number of hygiene practices and area*

Hygiene practices	Intervention area			Control area		
	N (%)	Mean	SD	N (%)	Mean	SD
Total	389(100)	3.4	2.8	390(100)	4.1	3.3
a) None	5 (1)	—	—	42 (11)	4.3	3.1
b) One only	50 (13)	4.9	3.3	102 (26)	5.1	3.7
c) Combinations of any two	91 (23)	4.0	2.8	130 (33)	3.9	3.0
d) Combinations of three	135 (35)	3.1	2.8**	93 (24)	3.3	3.1
e) All four	108 (28)	2.6	2.1**	23 (6)	2.8	2.7*

N (%) = number of child-years (per cent), SD = standard deviation,
* P<0.05; ** P<0.01 (compared with 'b' in intervention area and with 'a' in control area).

where none or only one was observed in the intervention and control areas respectively.

Diarrhoea incidence was higher if household size was larger and occupation of household head was in the higher category in both areas (Table 3). No difference in diarrhoea incidence was observed for education of the household head.

Table 4 shows coefficients of the multiple linear logistic regression models and their odds ratios of having none or one episode in a one-year period for different hygiene practices after controlling for household size, and education and occupation of household head for the intervention and control areas. In both areas, the risk of having none or one episode was significantly lower for the children living in the households where three or four hygiene practices were observed than those who lived in households where none or only one practice was observed. The risk was more than 70% lower for children living in the households which observed four hygiene practice than in those which observed none or one practice. Household size and occupation of household head were not significant once hygiene practices

TABLE 3   *Diarrhoea incidence per child-year by household socio-economic characteristics and area*

Risk variable	Intervention area			Control area		
	N	Mean	SD	N	Mean	SD
1. Household size:						
a) <7 members	198	3.2	2.7**	192	3.9	3.4
b) 7+ members	191	3.7	2.8	198	4.2	3.2
2. Education of household head:						
a) No schooling	356	3.4	2.8	368	4.0	3.3
b) Schooling 1 year+	33	3.9	2.6	22	4.7	3.3
3. Occupation of household head:						
a) Lower category	145	3.1	2.3*	177	3.6	3.1**
b) Higher category	244	3.6	3.0	213	4.4	3.4

SD = standard deviation
* P<0.10, ** P<0.05 ('a' compared with 'b').

TABLE 4 *Coefficients of multiple logistic regression model of having none or one episode annually on selected risk factors by area*

Risk factors	Reference category	Intervention area		Control area	
		Coefficient	Odds ratio (95% CI)	Coefficient	Odds ratio (95% CI)
1. Two practices	No more than one practice	−0.629	0.53 (0.21−1.37)	−0.121	0.87 (0.49−1.60)
2. Three practices	No more than one practice	−1.162*	0.31 (0.13−0.75)	−0.843*	0.43 (0.24−0.78)
3. Four practices	No more than one practice	−1.311*	0.27 (0.11−0.66)	−1.422*	0.24 (0.09−0.61)
4. Schooling 1 yr + of HH head	No schooling	−0.697	0.50 (0.20−1.26)	−0.372	0.69 (0.22−2.19)
5. Higher occupational category of HH head	Lower category	−0.093	0.91 (0.56−1.48)	−0.419	0.66 (0.40−1.07)
6. Household size	Continuous (2−25)	−0.068	0.93 (0.86−1.01)	−0.020	0.98 (0.92−1.04)
Constant	——	1.720		1.334	

Cg (Chi-square with 8 df)   5.13, P>0.5   6.40, P>0.5

* $P < 0.01$

have been included in the model. The presented models fit the data well (Cg not significant).

DISCUSSION

This study demonstrated the importance of both mother's personal and domestic hygiene in preventing diarrhoea in young children in rural Bangladesh. Young children have the highest attack rates of diarrhoea during weaning.[21] This may be the result of contaminated traditional weaning food,[22,24] dirty water, and utensils. Poor household environment and the mother's unhygienic practices may also be important sources of contamination. It has been stressed earlier that the use of clean water should be accompanied by improvements in hygiene practices to reduce risk of diarrhoea.[11,23-25] Our study results also show that use of clean water (hand-pump water), absence of child's faeces in the yard or mother's handwashing, had a positive effect on reduction of diarrhoea incidence if observed together. In both areas, the incidence was more than 40% (Table 2) lower if four hygiene practices were observed rather than none or only one practice. This is supported by results of the multiple logistic regression analysis. Health and hygiene education together with clean water supply, had an impact on diarrhoea in Guatemala.[19] Maternal domestic hygiene behaviour also had an impact on childhood diarrhoea in the slum area of Dhaka city.[26-27] On the other hand, the introduction of clean water did not influence diarrhoea reduction in studies in Matlab, Bangladesh and Guatemala.[2-6] We have also found that

if the use of handpump water was the only hygienic measure adopted diarrhoea incidence was the same as if none of the practices was observed.

Using univariate analysis, diarrhoea incidence was higher for higher occupation group of household head and larger household size as was found in other studies[28-30] however was not significant in the logistic regression analysis. Education level was low and no effect on diarrhoea incidence was observed. However, minimal education is perhaps not a good indicator of socioeconomic status in this population.

This study however, may have some limitations. A single day's observation of maternal hygiene practices in the dry season may not be representative. Relative retrogression of hygiene behaviour in the wet season[27] may have increased the diarrhoea rates in the hygienically better group and hence made the difference smaller. However, we found significant differences in diarrhoea rates across the group of different number of observed hygiene practices which suggests that the differences could have been even larger for seasonally adjusted hygiene behaviour. Moreover, the use of separate personnel for providing education, collecting information on maternal personal and domestic hygiene and recording diarrhoea incidence as well as monthly rotation of the latter group from one area to another should have reduced the bias in workers' reporting of mother's hygiene and child's diarrhoea within each of the areas. However, this could not prevent potential bias resulting from workers' knowledge of which area was 'interven-

tion' and which 'control', but the consistency of our findings within each area as well as between them gives no evidence of such bias.

The impact of the educational intervention on maternal hygiene behaviour could be assessed only indirectly by comparing distributions of hygiene practices in two areas. Significant differences have been found (X^2=113.3, P<0.001) which may indicate success of the health education programme in promoting hygiene among the non-educated mothers of young children. Similar changes in behaviour were also observed following health education in Guatemala.[6,19]

Preventing transmission of diarrhoea through improvement in overall socioeconomic conditions is not likely to be achieved in the near future in most developing countries. More practical and readily available interventions are required urgently. This study shows that a combination of hygiene practices can significantly reduce diarrhoeal disease and improve the quality of life in poor communities. We conclude that to reduce diarrhoeal diseases, low-cost hardware for water and sanitation improvement should be coupled with a group of specific hygiene messages to motivate people to qualitative and quantitative changes in their behaviour, habits and health status.

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