

Characteristics of Children Hospitalized with Severe Dehydration and Persistent Diarrhoea in Bangladesh

N.H. Alam, A.S.G. Faruque, N. Dewan, S.A. Sarker,
and G.J. Fuchs

*ICDDR,B: Centre for Health and Population Research, GPO Box 128, Dhaka 1000
Mohakhali, Dhaka 1212, Bangladesh*

ABSTRACT

The study analyzed data from a systematic sample of children, aged less than five years, who presented with persistent diarrhoea (diarrhoea of more than 14 days duration). It aims to differentiate (a) non-severe persistent diarrhoea (with no or mild dehydration) and (b) severe persistent diarrhoea (with moderate or severe dehydration), and to identify individual characteristics associated with severe persistent diarrhoea. In total, 7,505 patients, who represented a 4% systematic sample of the patient population, were seen during January 1993-December 1995. Of them, 297 (4%) presented with persistent diarrhoea. The male:female ratio was 2:1. Eighty-three percent of them had mild or no dehydration, and 17% had moderate or severe dehydration. Severe malnutrition of the study patients defined as weight-for-age z-score <-3, weight-for-length z-score <-3 and length-for-age z-score <-3 were 33.9%, 9.7%, and 22.7% respectively. Only 3% had oedematous malnutrition, and 11% had xerophthalmia. Factors independently associated with severe persistent diarrhoea by logistic regression analyses were: number of watery stool >10 times during the last 24 hours prior to admission (OR, 10.0; CI, 1.2-87, p=0.03), lower respiratory tract infection (OR, 111; CI, 4.2-2955, p=0.004), and lack of mothers' education (OR, 7.8; CI, 1.4-41.9, p=0.016) after controlling for confounders. Awareness and health education of mothers or caregivers and better case management during acute diarrhoeal episode might prevent the development of severe persistent diarrhoea in young children. In addition, children with severe persistent diarrhoea might need special attention to have adequate rehydration and control of extraintestinal infections, including respiratory tract infection.

Key words: Diarrhoea, Infantile; Diarrhoea, Persistent; Diarrhoea, Acute; Child nutrition disorders; Dehydration; Bangladesh

Correspondence and reprint requests should be addressed to: Dr. N.H. Alam
Clinical Sciences Division
ICDDR,B: Centre for Health and Population Research
GPO Box 128, Dhaka 1000, Mohakhali, Dhaka 1212
Bangladesh
Email: nhalam@icddr.org
Fax:(880-2) 988 5657 and 882 3116

INTRODUCTION

Persistent diarrhoea, defined as episodes of acute diarrhoea lasting for 14 days or more (1), accounts for only about 3-20% of all diarrhoeal episodes (2-4). Since its case-fatality rate is as high as 60% (5-8), the problem has drawn attention of the clinicians and epidemiologists to develop effective treatment strategy. A number of

studies (9-18) have described the epidemiology, aetiology, risk factors, and clinical management of persistent diarrhoea. Unfortunately, reports on its clinical features, in terms of spectrum of disease severity, are inadequate. One report (19) has described two major clinical categories of persistent diarrhoea: (a) mild persistent diarrhoea with several daily loose stools, normal hydration status, and growth-faltering leading to more severe malnutrition, and sometimes, death due to diarrhoea or other illnesses and (b) severe persistent diarrhoea with dehydration due to a high purging rate (>7 mL/kg.h or very frequent large watery stools). Recently, in a WHO document (20), persistent diarrhoea has been classified on the basis of presence of dehydration either into persistent diarrhoea (with no dehydration) or severe persistent diarrhoea (with dehydration). It is obvious that patients with severe persistent diarrhoea need hospitalization. However, none of the studies has identified potential risk factors to predict the development of severe illness and whether severity is preventable by awareness of the caregivers or improved case management during an acute diarrhoeal episode. The present study was designed to document different clinical characteristics in young children presenting with persistent or severe persistent diarrhoea.

MATERIALS AND METHODS

Source of data: A database for the hospital surveillance system for 1993-1995 was used for this analysis. Over 120,000 patients with diarrhoeal illness are treated each year at the treatment centre of ICDDR,B: Centre for Health and Population Research. Since 1980, detailed information on a systematic sample of 4% of all patients attending the Centre has been maintained as part of a hospital-based surveillance system. Methods of data collection and screening for pathogens have been described previously (21). Patients are treated in an outpatient area with rehydration solution. Those who require further or special care are admitted to the Short Stay Treatment Ward or the Inpatient Ward, if necessary. After initial care, the patient or his/her guardian is interviewed by a specially-trained health worker, and information on sociodemographic features, antecedents, prevailing symptoms, and previous treatment is recorded in field-tested forms. A physician performs physical examination at the time of admission, including assessment of dehydration, and records the data on a pre-coded form. Anthropometric measurements of children are also done. A stool specimen is collected for culture and microscopy from each patient enrolled in the surveillance system. Information relating to

diagnosis, treatment, and outcome is also routinely recorded. Subsequently, data forms are carefully checked by an experienced research assistant and recorded into a microcomputer.

Children aged 1-60 month(s) were eligible for the present analysis. The following information was abstracted from the record of each child: age, sex, anthropometric measurements (weight-for-age, weight-for-length, and length-for-age (22) calculated as the percentage of the median of the National Center for Health Statistics standard and z-score), type of feeding, mother's level of education, family income, duration of diarrhoea, number of stools during the last 24 hours, dehydration status, presence of xerophthalmia, oedema of extremities, history of taking oral rehydration solution (ORS) or antimicrobial/antidiarrhoeal drugs before admission, and presence of acute lower respiratory tract infection diagnosed clinically, etc. Children with persistent diarrhoea were classified according to dehydration status: (a) non-severe persistent diarrhoea was defined as diarrhoea for a duration of >14 days with presence of no or mild dehydration, (b) severe persistent diarrhoea as diarrhoea for a duration of >14 days with presence of moderate or severe dehydration at presentation to the hospital. From this database, an unmatched case-control study was designed, with 50 children with severe persistent diarrhoea as cases. Two hundred forty-seven children with non-severe persistent diarrhoea represented the control group. The relationship between individual characteristics present with severe persistent diarrhoea was assessed using χ^2 -test or Fisher's exact test. Strength of association was determined by calculating odds ratio (OR) with 95% confidence interval (CI) around the ratio. To identify factors independently associated with development of severe persistent diarrhoea, multiple logistic regression analysis was performed after simultaneous controlling for confounders. In an effort to identify the best anthropometric measurements as the risk for severe persistent diarrhoea, we constructed three different logistic regression models using three different anthropometric indices keeping other variables constant in the model (Table 3). Epi Info (23) and EGRET (24) were used for statistical analysis.

RESULTS

A total of 7,505 patients, aged less than five years, who visited the Clinical Research and Service Centre (CRSC) of ICDDR,B during January 1993-December 1995, comprised the subjects under surveillance study. Of them, 295 (4%) had persistent diarrhoea (duration

>14 days). Table I shows the clinical characteristics of patients and type of care received at admission. There were nearly twice as many male than female children. Most children had some degree of malnutrition, and one-fourth required inpatient or intensive care. About 54% of the children's stool culture was positive for diarrhoeagenic pathogen, excluding diarrhoeagenic *Escherichia coli* (tests to identify diarrhoeagenic *E. coli* was not performed). The factors that were considered to be related to severe persistent diarrhoea are shown in Table 2. All the factors were analyzed in a univariate fashion, taking one at a time and comparing their occurrence in children with severe persistent diarrhoea. Young age <12 months; moderate and severe malnutrition (weight-for-age z-score <-2 and <-3, weight-for-length z-score <-3); watery stool; number of stools >10 times during the last 24 hours prior to admission; presence of *Vibrio cholerae* O1 in stool culture; presence of acute lower respiratory tract infection identified clinically; use of ORS at home; and lack of mothers' education were significantly more common in children with severe persistent diarrhoea.

To identify variables independently associated with severe persistent diarrhoea after simultaneous adjusting for confounders, we performed a multiple logistic regression analysis. Three different logistic regression models were constructed, taking one of three anthropometric indices (weight-for-age z-score <-3; weight-for-length z-score <-3; length-for-age z-score <-3) at a time and keeping the other explanatory variables (age, sex, duration of diarrhoea, stool character, type of enteropathogens, ORS use, antibiotic/antidiarrhoeal drug use, breast-feeding status, mothers' education, and family income) constant. Stool frequency >10 times during the last 24 hours prior to admission, presence of acute lower respiratory tract infection, and lack of mothers' education were significantly associated with severe persistent diarrhoea after controlling for the above-mentioned variables (Table 3). Similar results were also found when analyses were performed substituting anthropometric indices of severe malnutrition (z-score <-3) with moderate and severe malnutrition (z-score <-2).

DISCUSSION

Previous reports (2-4) from the ICDDR,B have shown that about 10% of children aged less than five years with diarrhoeal illness had the history of diarrhoea for more than 14 days. This is in contrast to our study children of the same age group in whom only 4% of them gave a history of diarrhoea for more than two

Table 1. Characteristics of patients with persistent diarrhoea attending ICDDR,B treatment centre (surveillance patients), 4% of total samples, 1993-1995

Parameter	No.	%
Total number of children (<5 years old) (4% sample) attended	7,505	
Total number of persistent diarrhoea patients	297	4.0
Sex: male/female ratio	192/105	1.8:1
Dehydration status		
None	27	9.0
Mild	220	74.0
Moderate	43	14.5
Severe	7	2.5
Nutritional status		
Weight-for-age (z-score)		
<-2	178	63.9
<-3	95	33.9
Weight-for-length (z-score)		
<-2	94	33.9
<-3	27	9.7
Length-for-age (z-score)		
<-2	140	50.4
<-3	63	22.7
Pedal oedema	9	3.0
Xerophthalmia	33	11.0
Pathogens identified		
<i>V. cholerae</i> O1	12	4.0
<i>V. cholerae</i> O139	5	2.0
Other vibrios	36	12.0
<i>Shigella</i>	31	10.0
<i>Campylobacter</i>	39	13.0
Rotavirus	26	8.8
<i>Giardia</i>	6	2.0
<i>Entamoeba histolytica</i>	2	0.7
<i>Cryptosporidium</i>	2	0.7
No pathogen identified	138	46.0
Mixed pathogens identified	35	12.0
Type of care received at ICDDR,B		
Outpatient	99	33.3
Short Stay Treatment Ward	117	39.4
Inpatient Ward	78	26.3
Referred to other hospitals	3	1.0

weeks. The definition of persistent diarrhoea was similar as in the earlier reports. However, the method of data collection was similar as in two other studies (2,3). The two-week diarrhoeal recall history was validated

Table 2. Comparison of individual characteristics in cases of severe persistent diarrhoea in children surveillance patients, 1993-1995

Variable	Study group severe persistent diarrhoea (n=50)		Comparison group persistent diarrhoea (n=247)		Odds ratio 95% CI	p value
	No.	%	No.	%		
Age (in months)						
<12	31	62.0	105	42.5	2.21 (1.13-4.32)	0.02
12-23	13	26.0	85	34.8	0.66 (0.31-1.36)	0.3
24+	6	12.0	57	22.7	0.47 (0.17-1.21)	0.13
Sex						
Male	29	58.0	163	66.0	0.71 (0.37-1.39)	0.36
Female	21	42.0	84	34.0	1.41 (0.72-2.73)	0.26
Duration of diarrhoea (days)						
15-21	42	83.7	197	79.8	1.16 (0.50-2.74)	0.87
22-36	7	14.3	42	17.0	0.79 (0.30-2.00)	0.75
36	1	2.0	8	3.2	0.61 (0.03-4.98)	1.00
Nutritional status (z-score)						
Length-for-age (<-2.0)	22/41	53.7	118/237	49.8	1.17 (0.57-2.39)	0.77
Length-for-age (<-3.0)	12/41	29.3	51/237	21.5	1.51 (0.67-3.34)	0.37
Weight-for-length (<-2.0)	19/41	46.3	75/236	31.8	1.85 (0.90-3.82)	0.10
Weight-for-length (<-3.0)	8/41	19.5	19/236	8.1	2.77 (1.02-7.38)	0.04
Weight-for-age (<-2.0)	35/43	81.4	143/237	60.3	2.88 (1.21-7.05)	0.01
Weight-for-age (<-3.0)	21/43	48.8	74/237	31.2	2.10 (1.04-4.27)	0.04
Presence of any diarrhoeal pathogens	24	48.0	106	44.7	1.14 (0.59-2.19)	0.79
<i>V. cholerae</i> O1	6	12.0	6	2.4	5.47 (1.55-21.34)	0.01
<i>V. cholerae</i> O139	1	2.0	4	1.6	1.20 (0.20-7.08)	0.85
Other vibrios	6	14.6	35	14.2	0.83 (0.29-2.22)	0.38
<i>Shigella</i>	3	6.0	28	11.3	0.50 (0.12-1.82)	0.59
Rotavirus	3	6.0	23	9.3	0.59 (0.14-2.20)	0.62
<i>Campylobacter</i>	5	10.0	34	13.8	0.37 (0.12-1.07)	0.07
<i>E. histolytica</i>	0		6	2.6	0.0 (0.0-4.69)	0.59
<i>G. lamblia</i>	1	2.0	2	0.8	2.5 (0.40-10.11)	0.42
<i>Cryptosporidium</i>	0		2	0.9	0.0 (0.0-20.51)	1.0
Watery stool	44	88.0	146	59.1	5.07 (1.98-13.78)	<0.0001
Frequency of stool >10 times in the last 24 h	35	70.0	92	37.2	3.93 (1.95-8.01)	<0.0001
Presence of oedema	3	6.0	6	2.4	2.06 (0.49-12.10)	0.17
Presence of acute lower respiratory tract infection	12	24.0	10	4.0	7.48 (2.78-20.32)	<0.0001
Xerophthalmia	3	6.0	30	12.1	0.46 (0.11-1.67)	0.31
Pedal oedema	35	70.0	154	62.3	1.41 (0.70-2.87)	0.38
Predominantly breastfed	35	70.0	154	62.3	1.41 (0.70-2.87)	0.38
Used ORS	49	98.0	206	83.4	9.07 (1.15-56.89)	0.01
Used antibiotics/antidiarrhoeal drugs	10	50.0	79	54.9	0.82 (0.29-2.30)	0.86
Lack of mothers' education	34	69.4	124	50.2	2.11 (1.06-4.23)	0.03
Family income (<US\$ 50.00)	27	55.1	114	46.2	1.37 (0.71-2.63)	0.39

Table 3. Results of logistic regression analysis with three different models

	Model 1		Model 2		Model 3	
	OR (95% CI)	p value	OR (95% CI)	p value	OR (95% CI)	p value
No. of stools >10 times during the last 24 h before hospitalization	10 (1.2-87)	p=0.03	10.7 (1.2-94)	p=0.03	10 (1.2-87)	p=0.03
Respiratory tract infection	111 (4.2-2955)	p=0.004	87 (3.5-2132)	p=0.006	144 (5-4347)	p=0.004
Lack of mothers' education	7.8 (1.4-41.9)	p=0.016	8.4(1.6-43.3)	p=0.01	8.4 (1.7-42.3)	p=0.009
Model 1 with weight-for-length z-score <-3						
Model 2 with weight-for-age z-score <-3						
Model 3 with length-for-age z-score <-3						

previously (25). This lower rate might be due to heightened awareness and better case management during the acute stage of diarrhoeal illness at household level. Of the 297 patients with persistent diarrhoea, 78 (26%) required hospitalization and were subjected to thorough clinical investigations, and received case management that included rehydration, dietary manipulation, and, sometimes, antibiotics for enteric infections or signs of extraintestinal infections. Children with severe persistent diarrhoea are assumed to require inpatient care. According to the WHO criteria of dehydration, 17% of the study patients had severe persistent diarrhoea, which is about 10% lower than those who are admitted for inpatient care. Other associated complications known to necessitate inpatient care for persistent diarrhoea cases include: pneumonia, sepsis, or severe malnutrition (26). Dehydration (moderate or severe) associated with diarrhoea (whether it is acute or persistent) not only attracts the attention of the health service personnel (physician or nurse), it also worries the parents. So, diarrhoea associated with significant clinical dehydration was selected as cases (severe persistent diarrhoea); report (27) with acute diarrhoea associated with dehydration (moderate or severe) was also leveled as severe disease.

Almost half of the children with persistent diarrhoea in this study had enteropathogens, including *V. cholerae* O1 and O139 which are usually associated with acute watery diarrhoea. Whether this is a superadded infection representing an acute and chronic phenomenon (28) cannot be ascertained from this study. The bacterial pathogens which are more associated with persistent diarrhoea are diarrhoeagenic *E. coli*, especially enteroadherent and enteropathogenic *E. coli* (29,30). Presence of diarrhoeagenic *E. coli* was not examined in this study. *Cryptosporidium* is significantly associated with persistent diarrhoea (10,31), but the number of isolates in this study is scanty. In the case-control

analysis, this study identified three factors significantly associated with severe persistent diarrhoea (both in univariate and multivariate analyses). These were: number of watery stools >10 times during the last 24 hours before hospitalization, respiratory tract infection, and lack of mothers' education. There is a common perception that more the number of watery stools the more the fluid loss leading to dehydration if the lost fluid is not properly replaced. Some studies also have shown that the frequency of stool >8 times per day is associated with dehydration in children, aged less than five years, suffering from acute diarrhoea (32,33). The association of dehydration in children suffering from respiratory tract infection with diarrhoea might be explained thus: the children with respiratory tract infection were sick, anorectic, reluctant to take fluid, including ORS, and more insensible water loss due to increased respiration rate. Lack of mothers' education and its association with dehydration in children with persistent diarrhoea signify her inadequate or lack of knowledge on appropriate child-caring practice even during the illness of a child. Maternal education was also identified as an important risk factor for severe illness in diarrhoea identified by the presence of dehydration in a case-control study (27), although the study was on acute diarrhoea in children. However, the mechanism of dehydration is similar in all types of diarrhoeal illnesses. The important indicators, like young age <12 months and severe malnutrition z-score <-3, were more common in severe persistent diarrhoea in univariate analysis, but could not be confirmed in multivariate analysis. Study on acute diarrhoea had confirmed severe malnutrition (<60% weight-for-age) and young age <12 months to be significantly associated with dehydration (34).

This study has similar limitations as are common in most observational studies. We relied on the history given by the parents at the time of the visit. So, the

duration of diarrhoea, use of antibiotics, and ORS use, for example, were not precisely known. The health workers obtaining the information, however, were not aware of the hypothesis regarding persistent diarrhoea and dehydration, and bias is unlikely. Assessment of dehydration in severely malnourished children, especially in marasmic and frank kwashiorkor patients might be difficult. Since the ICDDR,B treats a huge number (>120,000 per year) of diarrhoea patients, we rely on the clinical assessment of dehydration, because other reliable non-clinical methods are absent. Similarly, xerophthalmia was diagnosed and treated following the WHO guideline (35).

The study demonstrates that lack of mothers' education, frequent watery stool (>10 times during the last day of visit), and concomitant respiratory tract infection are significantly associated with severe persistent diarrhoea. As increased case fatality and difficulty in case management are associated with severe persistent diarrhoea, improved case management during acute diarrhoeal episode and health education of mothers of children suffering from acute diarrhoea might prevent the development of severe persistent diarrhoea. In addition, children with severe persistent diarrhoea need special attention during case management regarding rehydration therapy and control of respiratory tract infection.

ACKNOWLEDGEMENTS

This research was funded by the ICDDR,B: Centre for Health and Population Research supported by countries and agencies which share its concern for the health problems of developing countries. Current donors providing unrestricted support include: the aid agencies of the governments of Australia, Bangladesh, Belgium, Canada, Saudi Arabia, Sweden, Switzerland, the United Kingdom, and the United States of America; international organizations include United Nations Children's Fund (UNICEF).

We thank Mr. M.A. Rahman Patwary for his secretarial assistance.

REFERENCES

1. Persistent diarrhoea in children in developing countries: memorandum from a WHO meeting. *Bull World Health Organ* 1988;66:709-17.
2. Shahid NS, Sack DA, Rahman M, Alam AN, Rahman N. Risk factors for persistent diarrhoea. *Br Med J* 1988;297:1036-8.
3. Mahalanabis D, Alam AN, Rahman N, Hasnat A. Prognostic indicators and risk factors for increased duration of acute diarrhoea and for persistent diarrhoea in children. *Int J Epidemiol* 1991;20:1064-72.
4. Baqui AH, Black RE, Sack RB, Yunus M, Siddique AK, Chowdhury HR. Epidemiological and clinical characteristics of acute and persistent diarrhoea in rural Bangladeshi children. *Acta Paediatr* 1992;81(Suppl 381):15-21.
5. Bhan MK, Arora NK, Ghai OP, Ramachandran K, Khoshoo V, Bhandari N. Major factors in diarrhoea-related mortality among rural children. *Indian J Med Res* 1986;83:9-12.
6. Fauveau V, Henry FJ, Briend A, Yunus M, Chakraborty J. Persistent diarrhoea as a cause of childhood mortality in rural Bangladesh. *Acta Paediatr* 1992;81(Suppl 381):12-4.
7. Victora CG, Huttly SR, Fuchs SC, Nobre LC, Barros FC. Deaths due to dysentery, acute and persistent diarrhoea among Brazilian infants. *Acta Paediatr* 1992;81(Suppl 381):7-11.
8. Lima AAM, Fang G, Schorling JB, de Albuquerque L, McAuliffe JF, Mota S *et al.* Persistent diarrhoea in northeast Brazil: etiologies and interactions with malnutrition. *Acta Paediatr* 1992;(Suppl 381):39-44.
9. Malta L, Urrutia JJ, Simon A. Infectious agents in acute and chronic diarrhoea of childhood. In: Leenthal E, editor. *Chronic diarrhoea in children*. New York: Raven Press, 1984:237-52.
10. McAuliffe JF, Shields DS, de Souza MA, Sakell J, Schorling J, Guerrant RL. Prolonged and recurring diarrhoea in the northeast of Brazil: examination of cases from a community-based study. *J Pediatr Gastroenterol Nutr* 1986;5:902-6.
11. Guerrant RL, Schorling JB, McAuliffe JF, de Souza MA. Diarrhoea as a cause and an effect of malnutrition: diarrhoea prevents catch-up growth and malnutrition increases diarrhoea frequency and duration. *Am J Trop Med Hyg* 1992;47(Suppl):28-35.
12. Black RE, Brown KH, Becker S, Alim AR, Huq I. Longitudinal studies of infectious disease and physical growth of children in rural Bangladesh. II. Incidence of diarrhoea and association with known pathogens. *Am J Epidemiol* 1982;115:315-24.
13. Bhan MK, Bhandari N, Sazawal S, Clemens J, Raj P, Levine MM *et al.* Descriptive epidemiology of persistent diarrhoea among young children in rural northern India. *Bull World Health Organ* 1989;67:281-8.
14. Huttly SR, Hoque BA, Aziz KMA, Hasan KZ, Patwary MY, Rahaman MM *et al.* Persistent diarrhoea in a rural

- area of Bangladesh: a community-based longitudinal study. *Int J Epidemiol* 1989;18:964-9.
15. Torun B, Chew F. Recent developments in the nutritional management of diarrhoea. 3. Practical approaches towards dietary management of acute diarrhoea in developing communities. *Trans R Soc Trop Med Hyg* 1991;85:12-7.
 16. Tomkins A. Recent developments in the nutritional management of diarrhoea. 1. Nutritional strategies to prevent diarrhoea among children in developing countries. *Trans R Soc Trop Med Hyg* 1991;85:4-7.
 17. Larcher VF, Shepherd R, Francis DE, Harries JT. Protracted diarrhoea in infancy: analysis of 82 cases with particular reference to diagnosis and management. *Arch Dis Child* 1977;52:597-605.
 18. Boudraa G, Touhami M, Pochart P, Sottana R, Mary JY, Desjeux JF. Effect of feeding yogurt versus milk in children with persistent diarrhoea. *J Pediatr Gastroenterol Nutr* 1990;11:509-12.
 19. Bhan MK, Arora NK, Singh KD. Management of persistent diarrhoea during infancy in clinical practice. *Indian J Pediatr* 1991;58:769-74.
 20. World Health Organization. Division of Diarrhoeal and Acute Respiratory Disease Control. Management of childhood illness: access and classify the sick child age 2 months up to 5 years. Geneva: World Health Organization, 1995:45. (WHO/CDR/95.14.B).
 21. Stoll BJ, Glass RI, Huq MI, Khan MU, Holt JE, Banu H. Surveillance of patients attending a diarrhoeal disease hospital in Bangladesh. *Br Med J* 1982;285:1185-8.
 22. World Health Organization. Measuring change in nutritional status: guidelines for assessing the nutritional impact of supplementary feeding programmes for vulnerable groups. Geneva: World Health Organization, 1983. 101 p.
 23. Epi Info Version 6. Atlanta, GA: Centers for Disease Control, 1990.
 24. Mauriten R. EGRET. Seattle, WA: Statistics and Epidemiology Research Corporation, 1986.
 25. Stanton B, Clemens J, Aziz KMA, Khatun K, Ahmed S, Khatun J. Comparability of results obtained by two-week home-maintained diarrhoeal calendar with two-week diarrhoeal recall. *Int J Epidemiol* 1987;16:595-601.
 26. Sibal A, Patwari AK, Anand VK, Chhabra AK, Chandra D. Associated infections in persistent diarrhoea—another perspective. *J Trop Pediatr* 1996;42:64-7.
 27. Mahalanabis D, Faruque ASG, Islam A, Hoque S. Maternal education and family income as determinants of severe disease following acute diarrhoea in children: a case control study. *J Biosoc Sci* 1996;28:129-39.
 28. Black RE. Persistent diarrhoea in children of developing countries. *Pediatr Infect Dis J* 1993;12:751-61.
 29. Baqui AH, Sack RB, Black RE, Haider K, Hossain A, Alim ARMA *et al.* Enteropathogens associated with acute and persistent diarrhoea in Bangladeshi children less than 5 years of age. *J Infect Dis* 1992;166:792-6.
 30. Lanata CF, Black RE, Gillman RH, Lazo F, Del Aguila R. Epidemiologic, clinical, and laboratory characteristics of acute vs. persistent diarrhoea in periurban Lima, Peru. *J Pediatr Gastroenterol Nutr* 1991;12:82-8.
 31. Sallon S, Deckelbaum RJ, Schimid II, Harlap S, Baras M, Spira DT. *Cryptosporidium*, malnutrition and chronic diarrhoea in children. *Am J Dis Child* 1988;142:312-5.
 32. Zodpey SP, Deshpande SG, Ughade SN, Hinge AV, Shrinkhande SN. Risk factors for development of dehydration in children aged under five who have acute diarrhoea: a case control study. *Public Health* 1998;112:233-6.
 33. Fuchs SC, Victora CG, Martinez J. Case-control study of risk of dehydrating diarrhoea in infants in vulnerable period after full weaning. *Br Med J* 1996;313:391-4.
 34. Bhattacharya SK, Bhattacharya MK, Manna B, Dutta D, Deb A, Dutta P *et al.* Risk factors for development of dehydration in young children with acute diarrhoea; a case-control study. *Acta Pediatr* 1995;84:160-4.
 35. World Health Organization. Strategies for the prevention of blindness in national programmes: a primary health care approach. 2d ed. Geneva: World Health Organization, 1997. 104 p.