

International Differences in Clinical Patterns of Diarrhoeal Deaths: A Comparison of Children from Brazil, Senegal, Bangladesh, and India

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ABSTRACT

Population-based data on deaths due to diarrhoea among children less than 5 years of age were obtained from areas of Brazil (227 deaths), Senegal (531), Bangladesh (236) and India (146). Fatal episodes of diarrhoea were classified as either acute diarrhoea, dysentery, or persistent diarrhoea based on their duration and on the presence or absence of blood in the stools. Persistent diarrhoea accounted for over 60% of infant diarrhoeal deaths in Brazil, 47% in India, 36% in Senegal, and 26% in Bangladesh. In the latter two studies, over one-half of infant diarrhoeal deaths were due to acute watery episodes. Among children 1-4 years old dying from diarrhoea, persistent episodes were the most common in Senegal and India, whereas dysentery was the leading pattern in Bangladesh. These differences may be related to the use of oral rehydration therapy and the utilisation of health care, as well as to environmental characteristics, and are relevant for planning control strategies. Further data are required from other parts of the less developed world.

Key words: Diarrhoea; Mortality; Dysentery; Fluid therapy.

INTRODUCTION

Limited information is available on the clinical characteristics of fatal childhood diarrhoea in less developed countries. The few available studies (1-3) suggest that one-third to one-half of all diarrhoea-associated deaths among children occurred following episodes of persistent diarrhoea, that is, those with a duration of 14 days or more. Information on the frequency of clinical patterns of fatal episodes (acute diarrhoea, persistent diarrhoea and dysentery) in various settings from less developed parts of the world will be useful for planning the prevention (4) and management of diarrhoeal episodes. For

example, the promotion of oral rehydration therapy (ORT) will help prevent deaths due to dehydration in children with acute watery diarrhoea (5-8), but is unlikely to reduce mortality due to persistent and dysenteric diarrhoeas. Therefore, lower proportionate mortality due to acute watery diarrhoea might be expected in areas with higher ORT-use rates.

The lack of reliable data on clinical patterns of diarrhoeal deaths has prompted the Programme for the Control of Diarrhoeal Diseases of the World Health Organization to support the setup of the present collaborative study.

MATERIALS AND METHODS

Over twenty research centres in less developed countries were contacted. For inclusion in the

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present collaborative study, these centres were requested to provide data on at least 100 diarrhoeal deaths in children less than 5 years old, either from a population-based or a health services-based study (only if 70% or more of all these deaths occurred in health facilities). Four centres (Brazil, Senegal, Bangladesh and India) were able to provide the necessary data, which are presented below.

The main characteristics of the areas served by each of the four collaborating centres are given in Table I. Most health indicators were better in Rio Grande do Sul, a relatively wealthy area of Brazil; poorest in Niakhar (Senegal); and Matlab (Bangladesh) and Ballabgarh (India) presented intermediate levels. The high reported usage of ORT in the Matlab area is to be noted.

Table I. Characteristics of the four study areas (some of these figures are the best available estimates)

	Brazil	Senegal	Bangladesh	India
Population (thousands)	2,500	24	100	64
Adult literacy rate	90%	7%	30%	39%
Infant mortality rate per thousand births	40	120	97	61
% deaths due to diarrhoea	12% ^a	35% ^b	15% ^b	18% ^b
Median duration of breast feeding (months)	3.3	24	30	11.5
Prevalence of mal-nutrition among under-fives ^c				
stunting	12%	20%	30% ^d	17%
wasting	3%	5%	27% ^d	4%
underweight ^e				74%
ORT use in diarrhoea	40%	4%	57%	45%
Number of diarrhoea deaths studied	227 ^a	531 ^b	236 ^b	146 ^b

a = Infants only;

b = All under-fives;

c = Below NCHS median minus two standard deviations;

d = Children 6-48 months;

e = Low weight-for-age.

Details of the study design in the four areas are shown in Table II. In Brazil, the two largest cities in the southern state of Rio Grande do Sul, Porto Alegre and Pelotas (joint population 2,500,000), were studied in 1985. Infant deaths were identified through regular visits to hospitals, coroner services, death registries and cemeteries, ascertainment being virtually complete. The case-notes of all children

who died were reviewed and their parents were interviewed by a physician. Two reviewers went through the available information independently to determine the underlying and associated causes of death. Disagreements were resolved by the study coordinator (CGV). This study was restricted to infant deaths.

In Senegal, the study covered a population of approximately 4,800 children less than 5 years old living in 30 villages in the district of Niakhar. From 1984 to 1988, data on child deaths were collected during the yearly census (1984-86) and through weekly visits to households (1987-88). Extensive verbal autopsy forms were filled out for each death and then analysed by at least two independent physicians. The data on ORT use refer to the beginning of the study period (1984).

Table II. Details of the study methods according to area

	Brazil	Senegal	Bangladesh	India
Study period	1985	1984-8	1988-9	1988-9
Age range of children (months)	0-11	0-59	0-59	0-59
Number of diarrhoea deaths studied	227 ^a	531 ^b	236 ^b	146 ^b
Type of surveillance	hospitals cemeteries registries	home visits	home visits	home visits
Frequency of surveillance	weekly	yearly (1984-86) weekly (1987-88)	bi-weekly	bi-weekly

a = Infants only; b = All less than 5 years.

In Bangladesh, the study was carried out in the rural Matlab area where a demographic surveillance system covered a population of approximately 100,000 during the years 1988-89. Each household was visited fortnightly by health workers; when a recent death was recorded, a health assistant obtained a history of the fatal illness. These histories were reviewed by a medical assistant supervised by two experienced physicians.

The data from India were obtained from a community health project in a rural area at Ballabgarh, Haryana state, near New Delhi, during 1988-89. All households in a community of 64,000 were visited every two weeks to detect births and deaths. The study supervisor applied a detailed questionnaire on every death, and the cause of death was established after a review by two physicians.

The studies included all child deaths with diarrhoea (the death of a child who presented diarrhoea during the fatal illness episode, either as the underlying or associated cause). All tabulations refer to these children. An attempt was also made to

identify those children for whom diarrhoea was considered to be the *underlying* cause of death, that is, that which started the chain of events which led directly to death.

Table III. Percental distribution of children dying with diarrhoea according to age and clinical pattern of the illness

Age group and clinical pattern of diarrhoea	Brazil	Senegal	Bangladesh	India
Infants				
Acute	28%	58%	52%	39%
Persistent	62%	36%	26%	47%
Dysentery	10%	6%	22%	14%
	(227)*	(160)*	(108)*	(92)*
1-4 years				
Acute	-	40%	20%	28%
Persistent	-	51%	21%	59%
Dysentery	-	9%	59%	13%
		(371)*	(128)*	(54)*
Less than 5 years				
Acute	-	46%	34%	35%
Persistent	-	47%	23%	51%
Dysentery	-	8%	42%	14%
		(531)*	(236)*	(146)*

* Number of deaths.

For each child, information was obtained on age, sex, presence of blood in the stools, diarrhoea duration and place of death. The following definitions were used for describing the clinical patterns of diarrhoeal deaths:

Dysentery: diarrhoea with the presence of blood in stools (more than just one or two streaks), regardless of duration

Acute diarrhoea: nonbloody diarrhoea lasting less than 14 days

Persistent diarrhoea: non-bloody diarrhoea lasting 14 days or more

To characterise a new diarrhoeal episode, a period of at least 48 hours without diarrhoea was required.

RESULTS

The clinical patterns of diarrhoeal deaths varied considerably between the four areas (Table III). In Brazil, 62% of the infants dying with diarrhoea had persistent episodes, compared to 47% in India, 36% in Senegal and 26% in Bangladesh (Figure 1). Dysentery deaths were relatively common in Bangladeshi infants (22% of deaths), and acute diarrhoeal deaths were more frequent in Senegal (58%).

Table III also shows mortality patterns for children 1-4 years old in Senegal, Bangladesh and

India (no such information was available from Brazil). In India and Senegal, 1-4 year old children who died were more likely to have persistent diarrhoea (and less likely to have acute episodes) than infants; in Bangladesh, dysentery was the most common type of diarrhoeal death among older children, and acute episodes became less important.

Table IV. Estimated infant mortality rate (per 1,000 live births) according to clinical pattern of diarrhoea

Clinical pattern of diarrhoea	Study			
	Brazil	Senegal	Bangladesh	India
Acute	1.3	23.2	7.8	5.0
Persistent	3.0	14.5	3.9	6.1
Dysentery	0.5	2.2	3.3	1.6
Total	4.8	39.9	15.0	12.7

In none of the four areas did these clinical patterns vary according to gender. The median durations of all fatal diarrhoeal episodes (including dysentery) were 24 days in Brazil, 15 in Senegal, 13 in Bangladesh and 29 in India. In Brazil, 82% of the deaths occurred in a hospital or health facility, compared to 5% in Senegal and in India, and 3% in Bangladesh.

Diarrhoea was considered to be the underlying, rather than an associated, cause of death in 75% of the deaths with diarrhoea in Brazil. In Senegal, Bangladesh and India, the respective percentages were 70%, 76% and 86%. There were no marked differences in terms of clinical patterns when the analysis was restricted to deaths in which diarrhoea was judged to be the underlying cause.

The above clinical pattern data (Table III), in conjunction with estimates of infant mortality rates and the proportion of infant deaths due to diarrhoea shown in Table I may be used to calculate the infant mortality rates for each diarrhoeal pattern (Table IV). Due to the high mortality levels in Senegal, and particularly to the high proportion of diarrhoeal deaths, infant mortality rates in that study tended to be the highest, whereas those from the Brazilian study were the lowest. It is noteworthy that dysentery mortality rates showed considerably less variations than the other clinical patterns.

DISCUSSION

Information on clinical patterns of diarrhoea mortality were obtained from four countries using simplified criteria, based only upon the duration of the fatal episode and on the presence of blood in the stools. Nevertheless, even such simple information proved difficult to obtain; only four centres were able to provide a sufficient number of deaths, out of over twenty which had been contacted.

Collating data from existing studies in different countries is bound to lead to comparability problems.

For example, no uniform definition of diarrhoea was used in the four studies, although this would probably not markedly affect mortality studies. Also, existing information on ORT-use rate was based on different surveys and may too have been affected by lack of consistency. Case ascertainment varied from place to place: in Brazil, it was based on surveillance of hospitals, cemeteries and registries, whereas in the other three areas surveillance took place at the home level. Nevertheless, it is unlikely that the present results would have been affected by these differences, and interesting findings have emerged.

Firstly, clinical patterns varied markedly from one setting to another. The most frequent pattern of diarrhoeal death among Brazilian infants was persistent diarrhoea; among children less than 5 years old in Senegal, acute and persistent diarrhoea were associated with equal proportions of deaths, dysentery being uncommon as a cause of mortality, whereas in Bangladesh the latter was the dominating type. In India, persistent diarrhoea was responsible for about one-half of all diarrhoeal deaths among those less than 5 years old and acute diarrhoea for one-third.

noted, however, that high ORT-use rates do not necessarily imply correct use (9). Nevertheless, the above findings are generally supportive of lower proportionate mortality from acute diarrhoea in areas where ORT-use rates are higher.

Other explanations for the differing clinical patterns may include variations in aetiological agents; environmental factors; nutritional status; maternal behaviour including breastfeeding, and personal and domestic hygiene; and health care availability and utilisation. The scope and quantity of the data currently available to the investigators does not allow a more refined analysis of the determinants of different clinical patterns.

These findings may be used for tailoring control programmes to each specific situation (10). In Senegal, for example, ORT promotion is certainly the number one priority for reducing diarrhoea mortality. In southern Brazil, however, additional efforts to increase ORT coverage would probably have little impact. While ensuring that high levels of ORT use are maintained, mortality would be more strongly affected by preventive measures aimed at reducing persistent diarrhoea, such as extending the extremely

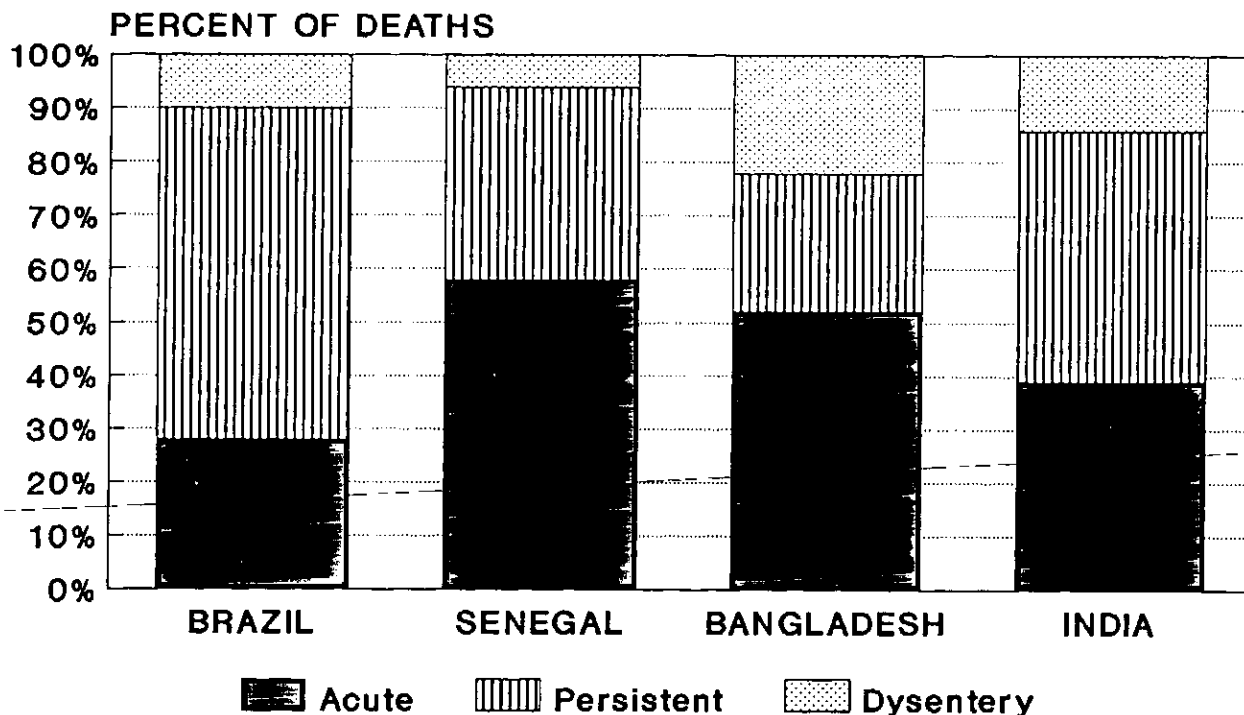


Figure. Distribution of diarrhoeal deaths among infants, according to clinical pattern

Secondly, although drawing conclusions on this issue from only four settings may be unwarranted, it is interesting that the highest proportion of deaths due to acute diarrhoea was observed in Senegal where the ORT-use rate was lowest. It should be

short duration of exclusive and total breastfeeding (11), and by the appropriate management of these prolonged episodes. In India, measures are needed to control persistent diarrhoea, but improved promotion of ORT for acute watery cases is also

required. In Bangladesh, on the other hand, special attention is required to acute diarrhoea among infants and particularly to dysentery among children of 1–4 years of age; hygiene behaviour interventions are likely to play an important role in reducing mortality due to the latter (12).

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