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Diarrhoea Morbidity Differentials among Children in Pakistan

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The present study used the 1995-96 Pakistan Integrated Household Survey data to determine the socio-economic, demographic, and environmental covariates of both prevalence and duration of diarrhoea among children under five in Pakistan. Seven logit models were estimated to determine factors influencing the probability of occurrence of diarrhoea. Seven Proportional Hazards Models were used to examine factors determining the duration of diarrhoea. Results revealed that around 20 percent of children under five suffered from diarrhoea in the 30 days prior to the survey. Child's age was negatively associated with diarrhoea morbidity. Children who had measles immunisation were less likely than children without this immunisation to have diarrhoea. The study also revealed that in controlling the occurrence of diarrhoea among children, sanitation facilities seemed to be more important than the supply of drinking-water. With respect to the duration of diarrhoea, the hazard models showed that younger children, particularly under the age of two, were relatively at a greater risk to suffer from longer diarrhoea episode. The use of *Nimkol* (ORT) showed a significant and positive effect on recovering quickly from the diarrhoea morbidity. The findings of the study suggest that mothers should be given health education so that they are familiar with the simply prepared treatment, *Nimkol*, and have knowledge about personal hygiene, and specially of preparing supplementary foods for children.

1. INTRODUCTION

About two-thirds of the total annual deaths in Pakistan are currently among children under the age of five, and diarrhoea is considered to be one of the major contributors to these deaths. In 1990, for example, 27 percent of under-five deaths were associated only with this disease. In the case of children aged 1–11 months, this association increased to 40 percent. In 1995, 229,000 deaths of children under five, constituting 30 percent of total deaths in this age group, were attributed to diarrhoeal disease [UNICEF and Gallup (1995) and UNICEF (1998)].

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Diarrhoea is usually caused by one of a number of food- or water-borne pathogens. The supply of adequate and clean drinking-water, improvements in sanitation facilities, and personal hygiene thus can play an important role in reducing the incidence of diarrhoea.

Pakistan's economic performance during the last 50 years has been respectable, with real GDP growth averaging 5.1 percent per year. Considerable progress has also been made in recent decades with respect to social indicators in the areas of health and education. But the country continues to fare badly in comparison with most other countries of the region at the same level of per capita income. Infant mortality is significantly higher in Pakistan than in India, Sri Lanka, and Bangladesh. Literacy levels in Pakistan are also well below regional averages [UNICEF (1998)]. Only half of its total population has access to safe drinking-water [Pakistan (1998)].

In response to this grave imbalance, the Government of Pakistan launched a five-year Social Action Programme (SAP-I) in 1992 to raise the status of human development by improving primary education, nutrition, primary health, population welfare, water supply, and sanitation. It was also one of the targets of this programme to reduce diarrhoea morbidity, which in fact has declined substantially since it was launched. But the 1996-97 Pakistan Integrated Household Survey (PIHS) indicates that, still, approximately one-sixth of children aged five years or less suffered from diarrhoea during the month preceding the survey [Pakistan (1998)]. In view of this high incidence, it is also one of the aims of the SAP-II, initiated in 1997, to bring about a significant drop in diarrhoea disease by the year 2000.

Studies conducted in developing countries have focussed on socio-economic and environmental variables that can affect the incidence of diarrhoea, particularly housing conditions, parental education, and income. Child morbidity differentials in Pakistan have not yet been examined: one of the major reasons seems to be the scarcity of reliable data. However, to monitor the success of various SAP initiatives, a series of four PIHS was launched in 1995-96.[1] With respect to child health, it has generated useful data on immunisation and levels and patterns of diarrhoea morbidity. This study aims to use the 1995-96 PIHS to determine the socio-economic, demographic, and environmental covariates of incidence of diarrhoea among children under five years of age.

Moreover, studies conducted in developing countries have largely ignored the 'duration of diarrhoea', which may provide greater insight into diarrhoea morbidity than does the occurrence of diarrhoea. The present study also aims to examine the factors that can influence the 'duration of diarrhoea' by estimating proportional hazard model. Thus the study will be a useful addition to the existing literature on diarrhoea morbidity among children. It will also make some policy recommendations to control the diarrhoeal diseases in Pakistan.

[1]Two surveys have already been completed and are available from the Federal Bureau of Statistics, Islamabad.

A theoretical discussion showing the variables that can affect diarrhoea morbidity in children is given in the next section, followed by methodology in Section 3. Section 4 reports the sample characteristics, while the prevalence of diarrhoea and its differentials are discussed in Sections 5 and 6. The penultimate section focuses on the ‘duration of diarrhoea’, followed by the conclusion and policy implications in the final section.

2. DIARRHOEA MORBIDITY DIFFERENTIALS: SOME THEORETICAL CONSIDERATIONS

The faecal-oral route transmits all pathogens that are known to be the major causes of diarrhoea. According to Feachem (1984), this transmission may be water-borne, food-borne, or direct. Water-borne transmission may occur when water contaminated by faeces is drunk. Food-borne transmission may occur when food contaminated by faeces is eaten. Direct transmission may occur when young children put their contaminated fingers in the mouth or the mothers contaminate food during its preparation. Thus safe disposal of human excreta, availability of uncontaminated water, and personal hygiene may lead to a major reduction in transmission of many, if not all, agents of diarrhoeal disease.

However, many water supply schemes in Pakistan, as in other developing countries, may be ineffective in reducing diarrhoea morbidity because it may be the quality and usage pattern of water in the home, not the purity of water at its source, that largely determines the impact of diarrhoeal morbidity on individual members of the community, particularly the children. It is likely that water storage in home containers may result in increased contamination depending on storage conditions [Esrey *et al*. (1984)]. Therefore, the uncontaminated source of water may become polluted by the time it is ingested. Similarly, the presence in a household of a latrine does not necessarily mean that a child uses it. In many communities, even where basic sanitation facilities exist and adults use them, young children are often permitted to defecate indiscriminately. So it is not easy to hypothesise whether it is the availability of sanitation facilities or it is the usage pattern of latrine in the home that transmits pathogens causing diarrhoea. The same seems to be true of the supply of water. However, it can be expected that increased water availability, associated with improved personal and household hygiene and safe disposal of human faeces, may lead to a major reduction in transmission of diarrhoeal disease.

Hygiene and literacy may be closely related. Although the evidence is inconclusive, some studies conducted primarily in Africa did show that diarrhoea rates were the highest in families with the lowest levels of educational attainment [Boerma and Ginneken (1996)]. But Feachem (1984) argues that such observations in themselves are not useful because families with the lowest educational attainment may be those with the lowest income, poorest housing, most crowding, and worst sanitary facilities. These confounding variables can promote the transmission of enteric pathogens. He further argues that if, after controlling the confounding variables, educational attainment shows a significant impact on the incidence of diarrhoea, the most likely reason is that educational differences cause behavioural differences that affect the transmission of enteric pathogens.

Several other factors such as age of the child, breast-feeding, measles immunisation, and rainy seasons may also be closely related with diarrhoea morbidity. The incidence of diarrhoea is usually the highest at 6–23 months of age. It declines after the second birthday [Yohannes *et al.* (1992); Boerma and Ginneken (1996)]. Breast-feeding plays a direct role in terms of protection against diarrhoea up to the age of 6 months, and also has an indirect effect, by its contribution to the nutrition of young children into the second year of life. Immunisation may not be directly related to diarrhoea morbidity but measles immunisation is likely to protect children against measles-associated diarrhoea. Diarrhoeal morbidity in the rainy season as compared with the other seasons is usually higher.

One important question is how parents, particularly mothers, manage diarrhoea illness when their children get sick? Many parents may regard diarrhoea as a normal part of life. Their perception about the illness thus would have some influence on the way they treat it. It is common in Pakistan to associate diarrhoea with ‘hot’, ‘teething’, ‘fallen fontanel’, ‘evil eye scutt’, and ‘contaminated food and water’. Teething is considered as part of normal growth process. If diarrhoea is perceived to be the outcome of an ‘evil eye’ then a *Pir* or *Maulvi* is frequently consulted [Jalil (1997)]. Thus a potentially dangerous disease may be treated with folk or false remedies, which can prolong its duration that might lead to dehydration.

It has been established that diarrhoea of any aetiology can be treated with Oral Rehydration Therapy (ORT), which is absorbed in the small intestine even in the presence of copious diarrhoea [Tyagi (1983)]. The Government of Pakistan has been promoting the use of *Nimkol*, the local name of ORS, since 1983 and its use has increased substantially. But probably because of differences in parental response to the diarrhoea disease, not all children are given *Nimkol* during the illness [Pakistan (1998)]. These children might face a more severe and longer duration of diarrhoea.

Because of data constraints, it is difficult to examine all possible theoretical relationships between different factors and diarrhoeal disease. An attempt has been made to examine key factors that can affect prevalence and duration of diarrhoea in Pakistan. The following three hypotheses are presented as a basis for examining some important relationships:

1. Improvements in environmental factors such as availability of safe drinking-water supply and proper excreta disposal can reduce the ingestion by young children of pathogens causing diarrhoea. This reduction can help reduce diarrhoea morbidity rates.

2. Education can cause behavioural changes that can reduce the transmission of enteric pathogens and thereby reduce diarrhoea morbidity rates.
3. Condition of children with diarrhoea who are given *Nimkol* improves more quickly as compared to that of children who are not given this oral therapy.

3. METHODOLOGY

The main data source for the present study was the 1995-96 PIHS that consisted of 12,800 households in 895 communities covering both rural and urban areas. Data were collected at individual, household, and community levels. Two separate questionnaires were administered to males and females. A sub-model focussing on diarrhoea among children was included in the female questionnaire.

The present analysis was restricted to children under five years of age. The PIHS identified 12174 children in this age group. The term diarrhoea was defined in the survey as 'the discharge of three or more watery stools in any given day'. The reference period was 30 days prior to the survey. The PIHS was administered throughout the year. This coverage is likely to have eliminated the effect of seasonality or, at least, intra-annual variation.

Although the PIHS has generated useful data on the diarrhoea disease, it has not been flawless. In the demographic and health surveys, usually a recall period of two weeks is considered the best balance between the quality of information and the representativeness of that information. But, as noted above, the recall period selected for the PIHS exceeds four weeks. Thus the possibility of occurrence of recall error cannot be ruled out.

In the Urdu translation of the female questionnaire, two local terms, *ishal* and *dast*, were used for diarrhoea. However, these are not the only terms used locally for this disease. Malik *et al.* (1992) identified in their anthropological study various other common terms, such as *Julab* and *Paichish*, for loose motions or diarrhoea. The use of different terminologies for diarrhoea might have affected mothers' responses.

For the present study, the 1995-96 PIHS sample was divided into four sub-categories: irrigated and *barani* within rural sector, and major urban centres (referred to hereafter as MUCs and other urban centres OUCs within the urban sector). The re-classification of rural areas was based on the percentage of cultivated area with irrigation facilities in each district, while the classification of urban areas was made on the basis of population size.[2] Among 4464 urban children, 1983 were located in the MUCs and 2481 in the OUCs. Similarly, out of 7710 rural children, 5598 lived in irrigated areas and the remaining 2112 in the *barani* areas (Appendix Table1). It appears from this reclassification that the 1995-96 PIHS sample was widely spread across the four geographical locations.

[2]This division was made in order to see any variation in diarrhoea morbidity across different ecological zones, which differ in climate, environmental setting, and socio-economic factors. For details on this classification, see Arif (1995).

As stated earlier, the main objectives of the present study were to determine the covariates of both prevalence and duration of diarrhoea among children under five. With respect to the prevalence, mothers were asked in the PIHS: Has this child (name) had diarrhoea during the last 30 days? The answer was recorded as 'yes' or 'no'. This answer was used to compute the rates of diarrhoea illness in the bivariate analysis. It was also used as the dependent variable in multivariate analysis. Since it is binary, the multivariate approach used was the logistic regression. This fits the model,

$$ln\,(p)/(1-p) = a + \sum b_i x_i$$

where p is the probability of a child having the diarrhoea illness during the 30 days preceding the survey, a and b_i are estimated regression coefficients, and x_i are the background characteristics, consisting of child's age and gender, his/her mother's age and educational attainment, household annual income, sources of drinking-water, toilet facilities, measles immunisation, and ecological zones.

In the 1995-96 PIHS, mothers were also asked: How many days did this child (name) have diarrhoea? They were further asked: Is the child still sick? These two questions show that information on duration of diarrhoea was complete for the children who, at the time of the survey, had already recovered from the last diarrhoea episode, while it was incomplete for those who until the time of interview were suffering from diarrhoea. So, for the analysis of diarrhoea duration, the latter were considered as censored cases, because their true duration cannot be observed. The hazard model technique is an appropriate method to reduce the problems associated with truncated data [Cox (1972)]. The general form of the proportional hazard model is:

$$h_x(t)=h_o(t)\,C_x$$

where $h_o(t)$ denotes baseline hazard function, x denotes a set of characteristics, and C_x is a multiplier specific to persons. In view of the non-negativity of h_x, the functional form used in the present study was the exponential:

$$h_x(t)= h_o(t)\,exp\,(b_1x_1 + b_2x_2+......+b_n x_n).$$

All variables but two, toilet facilities and measles immunisation, which were used in the logit equation, were also repeated in the hazard model. These two excluded variables may be important in the occurrence of diarrhoea, but they generally do not have any direct relevance with the duration of diarrhoea. Two new variables, the use of *Nimkol* during the recent episode of diarrhoea and the expenditures on treatment of diarrhoea, were included in the hazard model. The use of *nimkol* can reduce the severity of diarrhoea. It may thus have a positive relationship with the probability of recovering from diarrhoea, while expenditures on treatment of diarrhoea are expected to be negatively associated with this probability.

4. SAMPLE CHARACTERISTICS

Along with the information on age and gender of the selected children, their mothers' characteristics, average household annual income, sources of drinking-water and toilet facilities, and the proportion of children immunised against measles are given in Table 1. It shows that the selected children were evenly distributed in

Table 1

Percentage Distribution of Under-five Children by Selected Characteristics

Characteristics	N	%
Child's Gender		
Male	6140	50.4
Female	6034	49.6
Child's Age		
0	1805 (105)	14.8
1	2122 (101)	17.4
2	2672 (101)	21.9
3	2773 (97)	22.8
4	2802 (107)	23.0
Measles Immunisation		
Yes	6631	54.5
No	5543	45.5
Mother's Age		
15–19	313	2.6
20–24	2236	18.4
25–29	3486	28.6
30–34	2698	22.2
35–39	1790	14.7
40–44	793	6.5
45–49	362	3.0
Mother's Education		
Illiterate	9796	80.5
Primary[a]	1550	12.8
Matriculation	828	6.8
Type of Toilet Facilities		
Flush[b]	2192	18.0
Other	9982	82.0
Source of Drinking-water		
Piped/Motor-pump	4498	36.9
Other	7676	63.1
Average Annual Income (HH)	4681	

Source: Computed from the 1995-96 PIHS.

[a]Primary category includes primary and middle (till 8th class).

[b]The flush category includes flush system with underground drainage or soak-pit.

Note: Age-wise gender ratios are given in parentheses.

the five age groups reported. About 15 percent of them were less than one year old when the PIHS was conducted, while 17 percent of the children had completed their first birthday. The share of 2-year old children was about 22 percent. For the 3- and 4-year old children, it was 23 percent. The gender ratio of the selected children was 102. Age-wise ratios, however, fluctuate from 105 for the youngest age group to 97 for the 3-year old children.

Table 1 shows that the mean age of children's mothers was approximately 30 years, and more than half of them were in age group 25–34. Mothers of only 20 percent children had some formal education. Average annual household income of the selected children was about 4700 rupees. Only 37 percent of children lived in a household that had the facility of piped water, or the water was supplied through a motor-pump inside the house. Toilet facilities with flush system were available to less than one-fifth of the selected children. Table 1 also shows that coverage of measles immunisation was not universal: only half of the children had received this vaccination.

5. DIARRHOEA MORBIDITY AND ITS DIFFERENTIALS

5.1. Prevalence of Diarrhoea

According to the 1995-96 PIHS, the main data source for the present study, around 20 percent of the selected children under five suffered from diarrhoea in the 30 days prior to the interview (Table 2). This prevalence rate was 15 percent and 26

Table 2

Prevalence Rate (%) of Diarrhoea Morbidity among Children Under-five, By Rural/Urban Area and Province

Rural/Urban and Province	PIHS 1995-96	MICS 1995	PDHS 1990-91
Rural Areas	**21.0**	**27.0**	**14.3**
Irrigated	20.8	–	–
Barani	**21.6**	**–**	**–**
Urban Areas	**16.7**	**23.0**	**15.0**
MUCs	16.2	–	–
OUCs	17.2	–	–
Province			
Punjab	22.8	21.0	14.4
Sindh	14.5	33.0	19.6
NWFP	18.3	25.0	9.6
Balochistan	13.9	17.0	8.3
Total	**18.9**	**26.0**	**14.5**

Source: For the PIHS 1995-96, computed from the primary data; For the MICS 1995, UNICEF and Gallup (1995), and for the PDHS 1990-91, NIPS (1992).

percent, respectively, in the 1990-91 Pakistan Demographic and Health Survey (PDHS) and the 1995 Multiple Indicators Cluster Survey (MICS). These variations in the rates can primarily be attributed to differences in the reference period, the seasons selected for the respective surveys, and the definition of diarrhoea used in the surveys. The PDHS, for example, was conducted in the winter season when the occurrence of diarrhoea is usually low. In contrast, the MICS was carried out during the summer, the peak diarrhoea disease season, when the temperature on average reached 45^{o}C. Because of the seasonality of the diarrhoea disease, with more cases occurring during the monsoon season and the hot season, the PDHS was likely to have underestimated annual prevalence. The MICS, on the other hand, may have overestimated the diarrhoea prevalence. Since the 1995-96 PIHS was conducted throughout the year, it may have eliminated the seasonality effect.

The reference period used in the 1995-96 PIHS also differed from the period used in the PDHS and the MICS. In the former, as noted earlier, it was 30 days prior to the survey, while the latter used a period of two weeks. This difference in the recall period is likely to have influenced the diarrhoea morbidity rates. Finally, the definition of 'diarrhoea' differed across the three surveys. It was defined in the PIHS as 'the discharge of three or more watery stools in any given day'. The MICS did not include in its definition the number of minimum stools in a day. Rather, it defined diarrhoea as 'the stool was like a liquid and the number of stools were more than the usual'. The PDHS simply relied on maternal perception on diarrhoea. From this comparison it can safely be concluded that although the 1995-96 PIHS used a longer recall period, it produced relatively better annual prevalence rate of diarrhoea, mainly because of both using a precise definition of diarrhoea and not limiting the survey to any one season.

5.2. Regional Differentials in Diarrhoea Morbidity

Table 2 also sets out data on prevalence rates of diarrhoea morbidity among children under-five for rural/urban areas and the four provinces of the country. The PDHS did not show a marked difference between the rural and urban areas in the prevalence of diarrhoea, probably because, as noted earlier, it was carried out in the winter season when the occurrence of diarrhoea is generally very low. But the other two surveys, the PIHS and the MICS, revealed that the diarrhoea prevalence rates were higher in the rural areas than in the urban areas.[3] Table 2 shows no substantial difference in diarrhoea morbidity within the rural (irrigated and *barani*) and the urban areas (the MUCs and the OUCs).

In all the three surveys, Balochistan had the lowest diarrhoea prevalence (Table 2). The highest prevalence, according to the 1995-96 PIHS, was found in Punjab, while in the other two surveys it was Sindh, where the occurrence of

[3]This difference almost persisted when the rural and urban prevalence rates of diarrhoea were further controlled for province areas by using the PIHS data (Appendix Table 2).

diarrhoea was the highest. These results are surprising since Balochistan is the least developed province of the country. However, it is likely that parents' perception about diarrhoea differs across the regions and the provinces. It may particularly be regarded in some areas of Balochistan as a normal part of the growth process, thus increasing the possibility of under-reporting of diarrhoea. Moreover, the relatively lower incidence of diarrhoea in Balochistan could be attributed to its dry terrain and land structure. The annual rainfall in Balochistan is substantially lower than in Punjab [Pakistan (1998)].

5.3. Age Gender Differentials

The age gender-specific morbidity rates of the selected children are shown in Table 3. The gender differentials fluctuated from age group to age group, although the overall levels were very similar for both sexes. For both, the males and females, diarrhoea morbidity rate peaked at age 1. The rate in this age group was substantially higher for males than for females. After age 1 it declined steadily for both sexes. A similar pattern was observed when the prevalence rates were controlled for rural/urban areas (Figures 1 and 2). This pattern also remained unchanged when the age gender-specific morbidity rates were controlled by province (Appendix 3). These findings regarding the age pattern of diarrhoea morbidity are consistent with studies conducted in other developing countries, which showed relatively higher diarrhoeal disease in the first two years of life [Yohannes *et al.* (1992)]. This pattern could be due to exogenous factors such as an increased exposure to contaminate weaning foods in the second year of life, at an age when the immune system is weaker in younger children than in older children.

Table 3

Prevalence Rate (%) of Diarrhoea Morbidity among Children Under-five, By Age and Gender

Child's Age (Years)	Total	Male	Female	Male/Female Difference
0	22.1	21.7	22.5	–0.8
1	30.2	33.5	26.7	6.8
2	23.3	22.2	24.3	–2.1
3	14.8	14.9	14.8	0.1
4	11.8	12.0	11.5	0.5
All	19.8	20.2	19.4	0.8

Source: Computed from the 1995-96 PIHS data set.

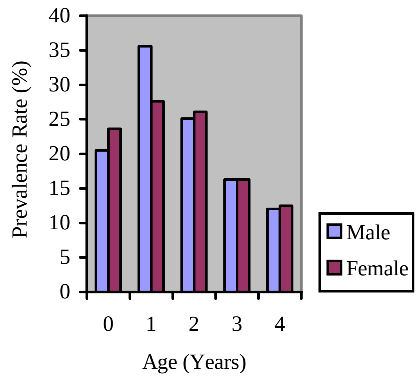

Fig. 1. Prevalence Rate (%) of Diarrhoea Morbidity by Age Controlling for Gender (Rural Areas).

Fig. 2. Prevalence Rate (%) of Diarrhoea Morbidity by Age Controlling for Gender (Urban Areas).

5.4. Environmental Factors and Diarrhoea Morbidity

The relationship between diarrhoea morbidity among children under-five and the three variables that are taken as indicators of environment, sources of drinking-water, type of toilet facilities, and season, are shown in Table 4. Children living in households having piped water or a motor-pump inside the house were less likely to be sick than children in households having other sources of water including hand-pump, well or river. This is the expected pattern since piped water is normally assumed to be less contaminated than other sources. Table 4 also shows that the prevalence of diarrhoea among children who lived in households that had a latrine with flush system was substantially lower than among those who lived in households without the flush system.

There was a marked difference in the prevalence of diarrhoea between the rainy and the non-rainy seasons. In urban areas, the prevalence rate during the rainy season was more than twice the rate in the non-rainy seasons (Table 4). This difference persisted in the rural areas, though at a relatively lower scale. The seasonal pattern of diarrhoea morbidity was also observed in all ecological zones. According to Muhuri (1996), diarrhoea diseases may increase in the rainy season by several transmission routes, such as the faecal pollution of surface water, worsening of the physical environmental conditions, and poor food handling because the rainy season may impose a heavy pressure on rural mothers.

Table 4

Prevalence Rate (%) of Diarrhoea Morbidity among Children Under-five, By Environmental Conditions, Controlling for Rural/Urban Areas and Ecological Zones

Mother's Characteristics	Urban Areas			Rural Areas			Total Sample
	MUCs	OUCs	All	Irrigated	*Barani*	All	
Water Source							
Piped/Motor-pump	15.3	14.7	15.0	17.9	15.9	17.2	15.8
Other	21.7	16.5	18.0	18.6	17.9	18.4	18.3
Laterine							
Flush[a]	14.2	13.6	14.1	13.7	11.5	13.5	13.8
Other	18.8	15.9	16.9	19.3	17.7	18.8	18.2
Season							
Rainy	30.0	44.9	43.8	27.2	28.2	27.4	27.5
Non-rainy	16.2	16.8	16.5	16.3	18.8	16.9	16.7

Source: Computed from the 1995-96 PIHS data set.

[a]The flush category includes flush system with underground drainage or soak-pit.

5.5. Mothers' Age and Education and Diarrhoea Morbidity

Table 5 shows no consistent relationship between the occurrence of diarrhoea and the age of mother. In fact, there was a great fluctuation in the morbidity rates across different age groups of mothers. The level of maternal educational attainment, however, did show an association with diarrhoea morbidity. The prevalence of diarrhoea decreased with higher education, particularly for mothers with a matriculate or higher level of education. This relationship holds even after controlling for rural-urban areas and ecological zones (Table 5). The most likely reason, as discussed in Section 2, seems to be that educational differences cause behavioural differences that affect the transmission of enteric pathogens. But there is also the possibility that mothers with a lower educational attainment may be those with poor housing and worse sanitary facilities. These confounding variables can promote the transmission of enteric pathogens. Thus, to see the independent effect of mothers' education and other variables on the occurrence of diarrhoea in children, the confounding variables must be controlled.

Table 5

Prevalence Rate (%) of Diarrhoea Morbidity among Children Under-five, By Mother's Age and Education, Controlling for Rural/Urban Areas and Ecological Zones

Mother's	Urban Areas			Rural Areas			Total
Characteristics	MUCs	OUCs	All	Irrigated	*Barani*	All	Sample
Age							
15–19	32.9	12.7	22.2	25.7	27.2	26.1	25.4
20–24	18.4	22.3	20.2	23.2	20.9	22.7	22.0
25–29	14.9	17.0	15.9	20.6	16.9	19.7	18.6
30–34	12.9	16.6	14.7	21.5	27.1	22.8	20.5
35–39	18.0	15.6	16.7	21.4	26.6	22.4	20.8
40–44	21.6	14.4	18.0	16.4	18.0	16.7	17.1
45–49	13.8	17.2	16.4	15.0	19.7	16.0	16.1
Education							
Illiterate	17.8	17.7	17.7	21.2	22.3	21.4	20.6
Primary	37.9	37.2	37.8	35.1	36.6	35.7	37.2
Matric and Above	11.2	10.1	10.9	15.8	10.6	14.1	11.5

Source: Computed from the 1995-96 PIHS data set.

6. DIARRHOEA MORBIDITY DIFFERENTIALS: MUTIVARIATE ANALYSES

The relative influence of different variables on the probability of a child's having diarrhoea morbidity in the 30 days prior to the 1995-96 PIHS was assessed in this section by the multivariate technique. The logit equation specified in Section 3 provided the basis for this assessment. Diarrhoea morbidity was defined as a dichotomous (had or had not diarrhoea during the reference period). Nine explanatory variables (Child's age and gender, its mother's age and education, household annual income, sources of drinking-water and toilet facilities, measles immunisation, and ecological zones) discussed in Section 3 were used in the analys7es. An operational definition of these variables is presented in Appendix Table 4. Seven models were estimated. Model 1, which is the full model, includes all the children under-five selected for the present study. Models 2 to 7 were estimated by focusing on the rural and urban areas and four ecological zones: irrigated and *barani* areas within rural sectors, and MUCs and OUCs within urban areas. All models were additive and summarised through odd ratios.

Results presented in Table 6 show the child's age to be strongly associated with diarrhoea morbidity. There was a steady decline in the odds of diarrhoea morbidity with child's age: three years old children were 70 percent less likely than infants to become sick, and this percentage declined further to 51 for four years old children. The gender variable had a positive and significant (at 10 percent level of confidence) effect on the probability of diarrhoea morbidity, suggesting that males under five were more likely than females to get diarrhoea. It may primarily be attributed to biological differences [Khan (1994)]. Age of the children's mothers did not turn out to be statistically significant, but mother's education did show an independent and significant negative effect on the diarrhoea morbidity (Table 6). After holding other variables constant, children of those mothers with a matriculate or higher level of education were less likely than children of illiterate mothers to get the diarrhoea disease (hypothesis 2). As expected, household income had a significant negative independent effect on the child's morbidity: the higher the income, the less likely the child was to get the diarrhoea disease.

It is a little surprising that a relatively safe source of drinking-water, piped/motor-pump inside the house, did not show significant association with diarrhoea morbidity, although this category had the expected negative sign (Table 6). As noted in Section 2, it may be the quality and usage pattern of water in home, not the purity of water at its source, that largely determines the impact on diarrhoea morbidity. Even the water that is pure at its source may become polluted as it passes through the damaged pipelines. The pattern of risk according to toilet facilities was as expected. Children living in houses having 'latrine with flush system' were less likely to be sick due to diarrhoea than children with no such facilities. Apparently, in terms of controlling diarrhoea morbidity, sanitation facilities seem to be more important than water supply. This finding, however, is not surprising. Esrey *et al.* (1985) showed similar results and argued that improvements in water quality at its source had less of an impact on diarrhoea morbidity than did improvements in excreta disposal.

Table 6 shows that the pattern of morbidity risk according to ecological zone has been altered by the control of other environmental variables. The relative risk was significantly higher for children residing in large urban centres, such as Karachi, Lahore, and Rawalpindi. It might be due to poor sanitation conditions in these centres. Children who had measles immunisation were less likely to be sick due to diarrhoea than children who did not have this immunisation. Finally, the odds of diarrhoea disease were significantly higher during the rainy season than in the non-rainy season.

The results of the Models 2 and 3, which examined the likelihood of children being sick for residing in rural and urban areas respectively, are also presented in Table 6. All the explanatory variables but ecological zones used in Model 1 were repeated in Models 2 and 3. As with Model 1, child's age, measles immunisation, household income, toilet facilities, and seasons were also statistically significant in Model 2, and the signs of the significant variables were also similar to the signs in Model 1. However, the level of educational attainment of child's mother that was

Table 6

Logistic Regression Effects of Predictors on Diarrhoea Morbidity among Children Under-five, 1995-96 PIHS (Odds Ratios)

Variables	Model 1 (Full)	Model 2 (Rural)	Model 3 (Urban)
Child's Age (Years)			
0	1.00	1.00	1.00
1	1.55*	1.75*	1.28**
2	1.03	1.19	0.83
3	0.70*	0.84	0.50*
4	0.51*	0.57*	0.42*
Child's Gender			
Female	1.00	1.00	1.00
Male	1.09**	1.08	1.14
Immunisation			
No	1.00	1.00	1.00
Yes	0.86*	0.89**	0.80*
Mother's Age			
<25	1.00	1.00	1.00
25–34	0.98	1.03	0.87
35+	1.03	1.10	0.92
Mother's Education			
Illiterate	1.00	1.00	1.00
Primary	1.12	0.98	1.32*
Matric +	0.75*	0.77	0.76**
Household Income	**0.97***	**0.94***	**0.98****
Water Source			
Well or No Source	1.00	1.00	1.00
Piped/Motor-pump	0.94	1.01	0.91
Toilet Facilities			
No Latrine/No Flush	1.00	1.00	1.00
Flush[a]	0.77**	0.72*	0.91
Ecological Zone			
Irrigated	1.00	–	–
Barani	**0.99**	**–**	**–**
Major Urban	1.54*	–	–
Other Urban	1.11	–	–
Season			
Non-rainy	1.00	1.00	1.00
Rainy	1.89*	1.87*	2.33*
LRX^2	10030	6414	3595
(N)	(11452)	(7170)	(4282)

Source: Computed from the 1995-96 PIHS data set.

Notes: *Shows significance at 5 percent or lower level of confidence.

**Shows significance at 10 percent or lower level of confidence.

[a]The flush category includes flush system with underground drainage or soak-pit.

significant in Model 1 did not turn out to be statistically significant in Model 2; probably very few mothers were educated in rural areas. The results of Model 3, which focused on urban areas, were different from Model 2 in two ways. First, mother's education that was insignificant in Model 2 (rural areas) turned out to be statistically significant in Model 3 (urban areas). Second, surprisingly, toilet facilities did not show a significant association with diarrhoea morbidity in Model 3.

The results of Models 4, 5, 6, and 7, which examined the propensities among children under-five to become sick according to ecological zones (irrigated, *barani*, MUCs, and OUCs) are presented in Table 7. The same variables that were used in Models 2 and 3 were repeated in these models. Child's age, measles immunisation, household income, household sanitation, and season were statistically significant in Model 4 (irrigated areas). Measles immunisation, however, was not statistically significant in Model 5 (*barani* areas). Measles may be less prevalent in *barani* areas. Within urban areas, child's age, mother's education, sources of drinking-water, and toilet facilities were statistically significant in Model 6 (MUCs), while child's age, household income, measles immunisation, mother's education, and season had significant effects on diarrhoea morbidity in Model 7 (OUCs).

Results of Models 2 to 7 reveal some important points. The pattern of relative risk according to child's age did not differ substantially across the ecological zones. The highest relative risk in all the zones was for age group 1. The effect of mother's education, however, was limited to those mothers who at least had 10 years of schooling and were residing in urban areas. Household income appears to be a strong determinant of diarrhoea morbidity. The household income probably helps to reduce diarrhoea morbidity among children under-five through improving their nutritional status and providing better sanitary conditions. The household income, like education, can also cause behavioural differences that affect the transmission of enteric pathogens. Finally, measles immunisation and season had independent effects on diarrhoea morbidity in most parts of the country.

7. DURATION OF DIARRHOEA MORBIDITY

Diarrhoeal infection usually cures itself in a matter of days, but in some cases its duration even exceeds to a couple of weeks. The nutritional status of a child can deteriorate due to a long episode of diarrhoea. Malnutrition in turn lowers the body's ability to resist infection by undermining the functioning of the main immune-response mechanism. This leads to longer, more severe, and more frequent episode of illness [UNICEF (1998)]. Thus the discussion on diarrhoea morbidity among children will only be complete when the duration of diarrhoea is also examined. This section focuses on this issue, and the analysis is restricted to those children who suffered from diarrhoea in the 30 days prior to the 1995-96 PIHS.

Table 8 reveals that 42 percent of those children who had diarrhoea during the reference period had recovered from the morbidity when the survey was carried out.

Table 7

Logistic Regression Effects of Predictors on Diarrhoea Morbidity among Children Under-five, By Ecological Zones, 1995-96 PIHS (Odds Ratios)

Variables	Model 4 (Irrigated)	Model 5 *(Barani)*	Model 6 (Major Urban)	Model 7 (Other Urban)
Child's Age (Years)				
0	1.00	1.00	1.00	1.00
1	1.65*	2.26*	1.39**	1.26
2	1.16	1.38	0.74	0.96
3	0.76*	1.21	0.39*	0.63*
4	0.57*	0.66	0.41*	0.44*
Child's Gender				
Female	1.00	1.00	1.00	1.00
Male	1.01	1.27**	1.15	1.11
Measles Immunisation				
No	1.00	1.00	1.00	1.00
Yes	0.86*	1.02	0.89	0.77*
Mother's Age				
<25	1.00	1.00	1.00	1.00
25–34	1.02	1.06	0.82	0.90
35+	1.03	1.35**	0.95	0.86
Mother's Education				
Illiterate	1.00	1.00	1.00	1.00
Primary	0.99	0.97	1.36*	1.17
Matric +	0.87	0.58	0.74**	0.63**
Household Income	**0.94***	**0.92***	**1.00**	**0.93***
Sources of Drinking-water				
Well or No Source	1.00	1.00	1.00	1.00
Piped/Motor-pump	1.02	0.98	0.75*	1.04
Toilet Facilities				
No Latrine/No Flush	1.00	1.00	1.00	1.00
Flush[a]	0.69*	0.95	0.76*	0.95
Season				
Non-rainy	1.00	1.00	1.00	1.00
Rainy	1.75*	2.30*	1.78	2.45*
LRX^2	4793	1605	1648	1913
(N)	(5281)	(1889)	(1914)	(2368)

Source: Computed from the 1995-96 PIHS data set.

Notes: *Shows significance at 5 percent or lower level of confidence.

**Shows significance at 10 percent or lower level of confidence.

[a]The flush category includes flush system with underground drainage or soak-pit.

Table 8

Percentage Distribution of Children who Suffered from Diarrhoea during the 30 Days Prior to the Interview, By Duration of Diarrhoea, Controlling for Their Status of Illness at the Time of Survey

Duration of Diarrhoea	Recovered from Diarrhoea when the Survey was Conducted	Still Suffering from Diarrhoea when the Survey was Conducted	All Children who had Diarrhoea during the 30 Days Prior to the Survey
1–3 Days	21.2	28.9	25.7
4–7 Days	37.4	43.7	41.1
8–14 Days	21.9	16.5	18.7
≥15 Days	19.5	10.8	15.4
All	100.0	100.0	100.0
(N)	(892)	(1255)	(2147)
Mean	8.85	6.90	7.61

Source: Computed from the 1995-96 PIHS data set.

In other words, more than half of the children were still sick. For the analysis of diarrhoea duration, the ‘still sick’ children were considered as censored cases, because their true duration cannot be observed (see Section 3). Mean diarrhoea duration of the censored cases was slightly lower than the duration of those children who had recovered from the morbidity at the time when the survey was conducted. About one-fifth of the latter had been sick for more than two weeks, while the corresponding figure for the former was 11 percent.

To see the relative effect of different covariates on the duration of diarrhoea, the following hazard model was specified in Section 3:

$$h_x(t)=h_o(t)\ exp\ (b_1x_1 + b_2x_2+......+b_nx_n).$$

In this model, $h_o(t)$ the baseline hazard function is estimated with reference to a specified reference group, and relative risks of other groups are calculated in relation to the baseline group by exponentiating the regression coefficient, i.e., *exp(B)* which represents the effects of the covariate on the hazard function for the reference groups [Sahu *et al.* (1996)].

Operational definitions of the explanatory variables (Appendix Table 4) used in the hazard model were similar to those used in the logit models.[4] Seven models were estimated: Model 1, which is the full model, includes all children who had diarrhoea during the reference period. Models 2 and 7 focus on rural and urban areas and four ecological zones: irrigated and *barani* within rural areas, and the MUCs and the OUCs within urban areas. Results of these seven models are presented in Table 9 and 10, where

[4]As noted in Section 3, two new variables, *Nimkol* and expenditure on treatment of diarrhoea, were added in the hazard model. The variable *Nimkol* takes the value of 1 if it was administered during the last episode of diarrhoea, and 0 otherwise. Total expenditure incurred on the treatment of the diarrhoea illness was entered in rupees in the model.

Table 9

Relative Risk of Making Transition from Diarrhoea Morbidity to Recovery, Estimating Proportional Hazards Models

Variables	Model 1 (Total)	Model 2 (Rural)	Model 3 (Urban)
Child's Age (Years)			
0	1.00	1.00	1.00
1	1.23**	1.24	1.26
2	1.23**	1.37*	1.08
3	1.37*	1.39*	1.43**
4	1.59*	1.67*	1.58*
Child's Gender			
Female	1.00	1.00	1.00
Male	0.98	0.69	1.00
Mother's Age			
<25	1.00	1.00	1.00
25–34	0.96	1.03	0.89
35+	0.76*	0.83**	0.65*
Mother's Education			
Illiterate	1.00	1.00	1.00
Primary	0.91	0.87	0.97
Matric +	1.08	0.72	1.33
Household Income	**1.00***	**1.00**	**1.00**
Medical Expenditure	0.99*	0.99*	0.99*
Sources of Drinking-water			
Well or No Source	1.00	1.00	1.00
Piped/Motor-pump	1.11	1.15	1.04
Nimkol Administered			
No	1.00	1.00	1.00
Yes	1.27*	1.31*	1.05
Ecological Zone			
Irrigated	1.00	–	–
Barani	1.07	–	–
Major Urban	1.09	–	–
Other Urban	1.00	–	–
Season			
Non-rainy	1.00	1.00	1.00
Rainy	0.80*	0.78*	1.35
LRX^2	12142	7072	3827
(N)	(1567)	(1012)	(555)

Source: Computed from the 1995-96 PIHS data set.

Notes: * Shows significance at 5 percent or lower level of confidence.
** Shows significance at 10 percent or lower level of confidence.

Table 10

Relative Risk of Making a Transition from Diarrhoea Morbidity to Recovery, Estimating Proportional Hazards Model by Ecological Zones

Variables	Model 4 (Irrigated)	Model 5 *(Barani)*	Model 6 (Major Urban)	Model 7 (Other Urban)
Child's Age (Years)				
0	1.00	1.00	1.00	1.00
1	1.08*	2.20*	1.45	1.15
2	1.29	1.89	1.02	1.15
3	1.30	1.85	1.70**	1.30
4	1.49*	2.62*	1.81*	1.54
Child's Gender				
Female	1.00	1.00	1.00	1.00
Male	0.98	0.90	1.12	0.92
Mother's Age				
<25	1.00	1.00	1.00	1.00
25–34	1.05	0.96	0.88	0.83
35+	0.92	0.57*	0.71	0.54*
Mother's Education				
Illiterate	1.00	1.00	1.00	1.00
Primary	0.88	0.69	1.05	0.84
Matric +	1.04	0.00	1.20	1.49
Household Income	**1.00**	**1.00***	**1.00**	**1.00**
Medical Expenditure	0.99*	0.99*	0.99	0.99
Sources of Drinking-water				
No Source	1.00	1.00	1.00	1.00
Piped /Motor-pump	1.30*	0.91	0.93	1.00
Nimkol Administered				
No	1.00	1.00	1.00	1.00
Yes	1.29*	1.44**	1.10	1.07
Season				
Non-rainy	1.00	1.00	1.00	1.00
Rainy	0.81*	0.74	0.00	1.56
LRX^2	5120	1306	1517	1824
(N)	(772)	(240)	(265)	(290)

Source: Computed from the 1995-96 PIHS data set.
Notes: * Significant at 5 percent or lower level of confidence.
** Significant at 10 percent or lower level of confidence.

values greater than 1 indicate that here the relative chance of recovering from diarrhoea was greater than for the reference group, whereas values less than 1 indicate lower relative risks.

The duration of diarrhoea was heavily influenced by child's age (Table 9). Its hazards increased from 1.23 for one-year old children to 1.59 for four-year old children, showing that the less the age the more the child was likely to have a longer episode of diarrhoea morbidity. This pattern is also evident from Figure 3, where the probability of suffering from diarrhoea, for different age groups, was plotted against the duration of diarrhoea (number of days). This probability declined steadily for all age groups, but after 10 days the decline was slow and the gap between different age groups did not narrow for a long period of time. This gap reveals that young children, particularly under the age of 2, were at a relatively greater risk of suffering from a longer episode of diarrhoea.

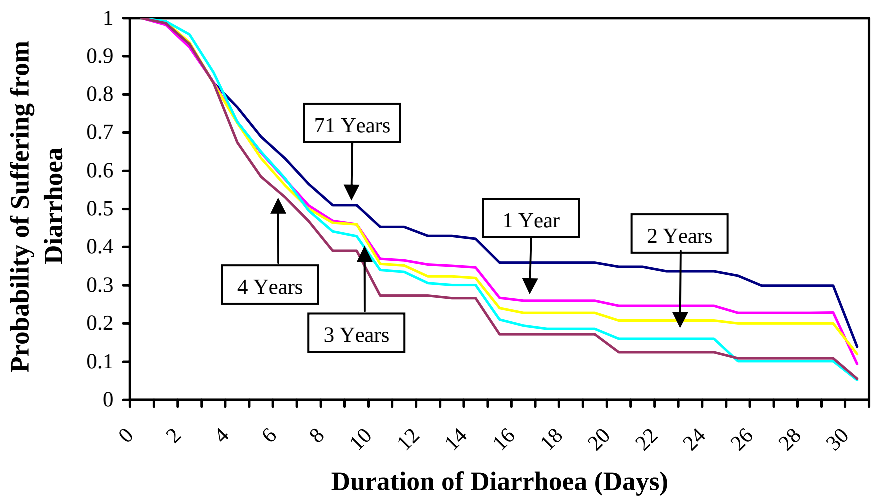

Fig. 3. Probability of Suffering from Diarrhoea, By Age of Child and Duration of Diarrhoea.

It is important to note that child's age was also strongly associated with the occurrence of diarrhoea in the logit models discussed in the previous section. This association was negative. It means that younger children were more likely to get the diarrhoea disease than older children. Now, results of the proportional hazard model (Table 9) indicate that the former were also more likely to have a longer episode of diarrhoea than the latter. It appears from the logit and hazard models that not only were young children, particularly under the age of two, vulnerable to the diarrhoeal disease but also that they were likely to face a relatively longer episode of the morbidity.

Regarding the mother's characteristics, two variables, age and education, were included in Model 1. Mother's age turned out to be statistically significant but the second variable, education, which showed a significant impact on the occurrence of diarrhoea in the logit models (see previous section), did not turn out to be significant in the proportional hazard model. The significance of mother's age shows that children of older mothers were relatively at a greater risk to have a longer episode of diarrhoea. The older mothers may regard diarrhoea as a normal part of life, thus they may not seek proper treatment for the diarrhoeal illness. Household income showed a significant and positive effect on the relative risk of recovering from diarrhoea. But medical expenditure incurred on the treatment of diarrhoea morbidity had a significant and negative effect on this risk.

Table 9 also shows that children who were given *Nimkol* during the current episode of diarrhoea were more likely to have recovered from the morbidity than children who were not given *Nimkol.* This suggests its importance in reducing the severity of diarrhoea among children under-five. Season had an independent negative impact on making the transition from morbidity to recovery. In other words, children who had diarrhoea during the rainy season were at greater risk to have a longer episodes of diarrhoea than those who had diarrhoea in the non-rainy season.

In Models 2 and 3, which examined the determinants of the duration of diarrhoea among children under-five living in the rural and the urban areas respectively, all variables but ecological zone used in Model 1 were repeated. Model 2 appears to be the mirror of Model 1. But in Model 3, household income and the use of *Nimkol* and season, which were significant in Models 1 and 2, could not turn out to be statistically significant.

Results of the proportional hazard models focusing on the ecological zones (irrigated, *barani*, the MUCs, and the OUCs) are presented in Table 10. Recovery from diarrhoea by child's age was found to have a similar pattern as shown in Table 9, except that in Model 7 (the OUCs) no single category of this variable turned out to be statistically significant. Age of the child's mother turned out to be significant in Models 5 and 7. Household income was significant in only Model 5, while medical expenditure incurred on the treatment of diarrhoea had a significant and negative effect on the chance of recovering from diarrhoea morbidity in Models 4, 5, and 6. Children who were not given *Nimkol* during the diarrhoea were at a greater risk to have a longer episodes of diarrhoea than those who were given *Nimkol.*

In sum, the estimated seven hazards models show that the age of both children and their mothers, use of *Nimkol*, and the expenditure incurred on the treatment of diarrhoea had strong associations with the duration of diarrhoea. Children borne to older women, probably living in poor households, were at a greater risk to suffer from a relatively longer duration of diarrhoea.

8. CONCLUSION AND POLICY IMPLICATIONS

The present study used the 1995-96 PIHS data set to determine the socio-economic, demographic, and environmental covariates of both prevalence and duration of diarrhoea among children under-five in Pakistan. Seven logit models were estimated to determine factors influencing the probability of occurrence of diarrhoea, and seven proportional hazards models were used to examine the factors determining the duration of diarrhoea. The overall picture drawn from this study has several implications for controlling the diarrhoea disease among children in Pakistan.

Child's age appeared to be one of the strong determinants of both prevalence and duration of diarrhoea. Its association with these two measures of diarrhoea morbidity was negative. It means that not only younger children, particularly under the age of two, were more vulnerable than older children to diarrhoeal infections, but they were also likely to have a relatively longer episode of diarrhoea. Although the number of diarrhoea episodes in a given year were not explored in the PIHS questionnaire, some other data sets did reveal that in Pakistan, on average, children had two to three episodes per year [UNICEF and Gallup (1995)]. The prolonged duration of diarrhoea, say more than two weeks, along with two or three such episodes in a year can badly affect the nutritional status of a child.

The SAP programme initiatives for controlling the diarrhoea disease should particularly focus on children less than two years old. Promotion of both breast-feeding, and of personal hygiene, while preparing the supplementary foods for these children, seems to be the right way to control diarrhoea.[5] It is well-established that breast-feeding provides young children protection against diarrhoeal infection. Similarly, personal hygiene of those who prepare food for children (usually mothers) can also play an important role in reducing the incidence of diarrhoea. Print and electronic media have been used in Pakistan to encourage mothers to breast-feed their babies for two years, but little has been done yet to educate them regarding personal hygiene and the preparation of supplementary food. Efforts for such education of mothers of young children need to be made.

The present study found a negative association between measles immunisation and occurrence of diarrhoea. There is a need to promote the importance of this immunisation and to make it available with both public and private health-care providers. Results of the study also confirmed that *Nimkol* was an effective remedy to reduce the severity of diarrhoea. The Government of Pakistan has been promoting its use since 1983. According to the 1995-96 PIHS data set, about three-quarters of the children suffering from diarrhoea were taken to a doctor or other health-care providers, but *Nimkol* was given to a smaller proportion of these children. The programme for controlling the diarrhoea disease should concentrate on reaching a larger number of health-care providers, with an emphasis to treat diarrhoea with

[5]As noted earlier, the 1995 PIHS data set did not contain information sufficient to examine the effect of breast-feeding and personal hygiene on diarrhoea morbidity.

Nimkol. There is also a need for a campaign to promote the use of *Nimkol* on a regular basis in the hot and rainy seasons. The slum areas of the country should be a particular focus of this campaign.

Sanitation facilities were also closely related with the occurrence of diarrhoea. The better the sanitation facilities, the less likely the child was to get the diarrhoea disease. These facilities in most parts of the country are far from satisfactory. Improvements in the existing poor sanitation conditions would bring about a significant drop in the incidence of diarrhoea. But, contrary to expectation, water supply did not show significant association with diarrhoea morbidity. As discussed earlier, it may be the quality and usage pattern of water in home, not the purity of water at its source, which largely determine the impact on diarrhoea morbidity. Even the water that is pure at its source may become polluted as it passes through the broken pipelines, a common phenomenon in urban localities where drinking-water is supplied through pipelines [Malik (1998)]. Repairing of these pipelines coupled with improvements in water storage patterns in home can help reduce the water-borne transmission of pathogens that cause diarrhoea.

Finally, it is true that the 1995-96 PIHS has generated useful data regarding the levels and patterns of diarrhoea illness. However, its main shortcoming was the use of 'one-month-long reference period' for diarrhoea morbidity. The period usually recommended for demographic and health surveys is of two weeks or even less than two weeks. To reduce the recall errors and to make the results comparable with studies conducted in other developing countries, a reference period of two weeks should be used in future surveys. There is also a need to add a few more questions in the future surveys concerning water storage pattern in homes, breast-feeding practices, and timings and types of weaning food, which will be useful in further research.

Appendices

Appendix Table 1

Distribution of Under-five Children Identified in the 1995-96 PIHS Sample, By Province and Type of Rural and Urban Areas

	Urban Areas			RuralAreas			Total PIHS
Province	MUCs	OUCs	All	Irrigated	*Barani*	All	Sample
Punjab	809	1012	1821	2767	393	3160	4981
Sindh	771	425	1196	1843	–	1843	3039
NWFP	235	546	781	810	951	1761	2542
Balochistan	168	498	666	178	768	946	1612
Pakistan	1983	2481	4464	5598	2112	7710	12174

Source: Computed from the 1995-96 PIHS.

Appendix Table 2

Prevalence Rate (%) of Diarrhoea Morbidity among Children Under-five, By Province and Rural/Urban Areas, Controlling for Gender of the Child

	All Areas			Urban Areas			Rural Areas		
Province	Total	Male	Female	Total	Male	Female	Total	Male	Female
Punjab	22.8	23.1	22.7	18.4	20.1	16.5	24.3	24.1	24.6
Sindh	14.5	14.8	14.1	13.8	13.0	14.7	14.9	16.3	13.7
NWFP	18.3	18.4	18.2	20.9	16.2	22.6	16.7	18.3	17.4
Balochistan	13.9	15.7	11.9	10.3	10.7	9.9	14.8	16.3	12.5
Pakistan	20.2	19.4	18.9	16.7	17.1	16.2	21.0	21.3	20.6

Source: Computed from the 1995-96 PIHS data set.

Appendix Table 3

Prevalence Rate (%) of Diarrhoea Morbidity among Children Under-five, By Province Controlling for Gender of the Child

Province	Punjab		Sindh		NWFP		Balochistan		
Age/Gender	Male	Female	Male	Female	Male	Female	Male	Female	Total
0	27.7	28.1	15.9	13.5	11.9	19.0	13.0	11.3	22.1
1	37.7	30.9	28.3	23.6	26.9	20.0	31.0	17.3	30.2
2	26.3	28.8	12.4	17.6	21.1	21.9	17.8	15.0	23.3
3	14.9	16.3	11.7	9.9	20.2	17.7	13.2	12.9	14.8
4	14.9	13.1	9.2	8.4	12.9	12.4	8.1	4.3	11.8

Source: Computed from the 1995-96 PIHS data set.

Appendix Table 4

Definitions of the Independent Variables

Variables	Definitions
Child's Age (Dummies)	Age 0 (<1 year) was the reference category
	Age 1 (1 year =1, Others = 0)
	Age 2 (2 year =1, Others = 0)
	Age 3 (3 year =1, Others = 0)
	Age 4 (4 years=1, Others=0)
Child's Gender	Male =1, Female = 0
Age of Mother (Dummies)	Age Group 15–24 was the reference category
	Age Group 15–34 =1, Others = 0
	Age Group >35 =1, Others = 0
Mother's Education	Illiterate was the reference category
	< Matriculate =1, Others = 0
	Matriculate + =1, Others = 0
Household Income (000 Rupees)	Continuous Variable
Sources of Drinking-water	Piped/Motor-pump[a] =1, Others = 0
Toilet Facilities	Flush System[b] =1, Others = 0
Immunisation	Child had Measles Immunisation = 1, No = 0
Ecological Zone	Irrigated areas was the reference category
	Barrani areas =1, Others = 0
	Major urban areas =1, Others =0
	Other urban areas =1, Others =0
Seasons	Rainy season (July, August, and September) =1, Others =0

Notes: [a]Refers to sources of drinking-water inside the house.
[b]Refers to flush system with underground drainage or soak-pit.

REFERENCES

Arif, G. M. (1995) International Contract Labour Migration and Reintegration of Return Migrants: The Experience of Pakistan. Unpublished Ph. D. thesis. Australian National University, Canberra.

Boerma, J. T., and J. K. van Ginneken (1996) Comparison of Substantive Results from Demographic and Epidemiological Survey Methods. In J. T. Boerma *Child Survival in Developing Countries: Can Demographic and Health Survey Help to Understand the Determinants?* Amsterdam: Royal Tropical Institute.

Cox, D. R. (1972) Regression Models and Life Tables. *Journal of the Royal Statistics Society,* Series B, 34: 187–202.

Esrey, A. R., R. G. Feachem, and J. M. Hughes. (1985) Interventions for the Control of Diarrhoeal Diseases among Young Children: Improving Water Supplies and Excreta Disposal Facilities. *Bulletin of World Health Organisation* 62:4 757–772.

Feachem, R. G. (1984) Interventions for the Control of Diarrhoeal Diseases among Young Children: Promotion of Personal and Domestic Hygiene. *Bulletin of World Health Organization.* 62:3 467–476.

Jalil, F. (1997) Child Feeding and Health. Islamabad. (Unpublished report).

Khan, M. R. (1994) Sickness, Disease, Treatments and Medical Costs by Socioeconomic Variables in Bangladesh. (Research Monograph 15.) 6–18.

Malik, I. A. *et al.* (1992) Mother's Fear of Child Death Due to Acute Diarrhoea: A Study of Urban and Rural Communities in Northern Punjab, Pakistan. *Social Science and Medicine* 35:8 1043–1053.

Malik, N. (1998) Water Contamination. *The News.* September 2.

Muhuri, P. K. (1996) Estimating Seasonality Effects on Child Mortality in Matlab, Bangladesh. *Demography* 33:1 98–110.

NIPS (1992) *Pakistan Demographic and Health Survey 1990-1991*. DHS, IRD/Macro International Inc.

Pakistan, Government of (1998) *Economic Survey 1997-98*. Islamabad: Federal Bureau of Statistics, Statistics Division.

Sahu, D., A. Pandey, and T. S. Sunil (1996) Determinants of Duration of Post-Partum Amenorrhoea in Gujarat: A Multivariate Life Table Analysis. *Demography India* 25:2 209–225.

Tyagi, B. N. (1983) A Review of Diarrhoeal Disease Control Programme in India. *Health and Population—Perspectives and Issues* 6:4 209–225.

UNICEF (1998) *The State of the World Children 1998*. New York: Oxford University Press.

UNICEF and Gallup Pakistan (1995) *Multiple Indicators Cluster Survey of Pakistan*. Ministry of Health, Government of Pakistan.

Yohannes, A. G., K. Streatfield, and L. Bost (1992) Child Morbidity Patterns in Ethiopia. *Journal of Biosocial Science* 24:2 143–155.