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PREFACE

The International Centre for Diarrhoeal Disease Research, Bangladesh (ICDDR,B) is an autonomous, international, philanthropic and non-profit centre for research, education and training as well as clinical service. The Centre is derived from the Cholera Research Laboratory (CRL). The activities of the institution are to undertake and promote study, research and dissemination of knowledge in diarrhoeal diseases and directly related subjects of nutrition and fertility with a view to develop improved methods of health care and for the prevention and control of diarrhoeal diseases and improvement of public health programmes with special relevance to developing countries. ICDDR,B issues two types of papers: scientific reports and working papers which demonstrate the type of research activity currently in progress at ICDDR,B. The views expressed in these papers are those of authors and do not necessarily represent views of International Centre for Diarrhoeal Disease Research, Bangladesh. They should not be quoted without the permission of the authors.

ABSTRACT

This paper examines the age specific mortality differentials of Matlab Demographic Surveillance area for 1974-1977, by socio-economic variables of the households. SES data from the 1974 census are used - classified on the basis of education, occupation and ownership of articles. Due to some matching problems of infant deaths with the household socioeconomic variables, analysis on infant mortality was not covered in this paper. For all other age groups it is observed that mortality is negatively correlated with SES status--higher levels having lower mortality rates. Among the various criteria "education of mother", shows the greatest statistical significance.

INTRODUCTION

Mortality rates - especially of infants - remain high in less developed countries. Within these countries as well as in affluent ones, demographers and medical professionals have become increasingly aware of the fact that health care is not reaching the various classes of society in an egalitarian manner. Mortality rates tend to be higher in "lower" classes of society. A recent WHO-UN sponsored conference in Mexico (1979) on the socioeconomic determinants of mortality has focused concern in this area. In third-world countries, reliable data do not exist to study the problem of mortality differentials. Indirect estimation procedures are resorted to, based on retrospective surveys.

The International Centre for Diarrhoeal Disease Research, Bangladesh (formerly the Cholera Research Laboratory) has operated a field station in a rural area of Bangladesh - in Matlab, Comilla District - since 1963. A demographic surveillance system has been maintained among 228 villages containing a population in 1974 of 276,679. The surveillance system consists of regular cross-sectional censuses and the longitudinal registration of vital events (births, deaths, migrations and marriages). Socioeconomic status data were collected in the 1974 census. Earlier collection of SES data on a few items was carried out in 1968 and 1970 on portions of the area under coverage called the old and new trial areas respectively. These data sets form an important resource that can throw light on some of the issues raised recently on the question of mortality.

Some of the implications of socioeconomic differentials in mortality for the health systems have been well developed by Antonovsky (1979) who states "It is incumbent upon us to urge the establishment of a systematic, continuous monitoring programme to assemble appropriate data." He points out that socioeconomic differentials in mortality mean that success has been achieved in one section of the community which is not available to other segments.

As regards the criteria for socioeconomic classification, a paper by Doring-Bradley and Johnston (1979) reviews the situation for several countries. The following are considered to have special relevance to mortality studies:

a) Occupation and status in employment
b) Income
c) Education
d) Industry
e) Housing condition
f) Urban and rural residence
g) National and ethnic groups.

However, the authors note that obtaining such data is difficult. Kitagawa and Hauser (1973) consider education as the most satisfactory of the several indices of socioeconomic status. Education defined by years of

schooling is generally reliably reported. In the case of India, Vaidyanathan (1972) has reported mortality differentials by geographical location, rural-urban habitat, religion and caste, occupation, education, type of housing and lighting, landholding, and income.

In India, Vaidyanathan (1972) has collected data from various surveys showing an inverse relationship between occupational class and mortality. Owners and tenant cultivators have lower mortality than agricultural labourers. White-collar workers have lower mortality rates than blue-collar workers. The UN Mysore Population Study (1961) uses the type of housing and type of lighting as a proxy for socioeconomic status in urban areas and landholding status in rural areas. Mortality differentials are as described above, with labourers and tenants having an infant mortality rate 59 percent above the rural rate. In the urban area of Bangalore City, the infant mortality rate for the population living in huts or mud houses with thatched roofs and for those without electric lighting was about 11 percent higher than the rate for the whole city population.

In Nigerian data, Caldwell has shown that education, especially that of the mother, is correlated negatively with child mortality rates (Caldwell, 1979). Preston has studied the changing relation between mortality and economic development (Preston, 1975).

According to a survey of the Committee for the International Cooperation in National Research in Demography, Paris survey, on-going research is listed for 30 centres, and 53 papers on socioeconomic differentials of mortality are cited (Doan 1979).

The Mexico Conference (1979) set of papers includes background papers for regions such as Latin America (Behm), Asia and the Pacific (Hashmi) and tropical Africa (Gaisie).

Since independence in 1971, Bangladesh has suffered two severe crisis periods, one linked to the liberation struggle and the other to the 1974 famine. Death rates have been higher during these periods, particularly among poorer groups (Chowdhury and Chen 1977). The 1975 crude death rate among landless families was three times that of families with 3 or more acres (McCord 1976 and 1980).

The Bangladesh Retrospective Survey on Fertility and Mortality (1974) has documented mortality differentials in childhood by socioeconomic status. Children of women who live in houses with walls of brick had a higher chance of survival than children whose mothers live in houses with walls of mud. Infant and child mortality decreased with the educational level of both husband and wife. These data are based on indirect estimation procedures, which have their own particular limitations. Vital registration is practically non-existent in Bangladesh and hence the main data sources on mortality differentials have to be obtained from small area surveys. Companiganj thana has been the scene of innovative health interventions, and survey data on mortality rates for a 10% sample exist (Langsten 1976).

Using the Matlab data set, D'Souza and Chen (1979) have focused on sex biases of mortality differentials. Earlier work on the same subject has been recorded in the Matlab area (Ruzicka and Chowdhury 1978). Occupation has been correlated with mortality differentials in the Matlab area (Chowdhury and Aziz 1974). Becker (1978) has studied relationships between seasonality data of deaths with SES.

Chen *et al.* (1979) have shown that children under 5 constituted 53.1 percent of all deaths in the period 1975-77. Among infants the most significant cause of deaths was tetanus. Tetanus neonatorum accounted for 26.2 percent of all infant deaths. A significant shift in causes of death occurs for children under 1-4 years. 43.9 percent of deaths were due to diarrhoeal diseases. Measles was the next cause of death with 13 percent. The paper associates under 5 mortality with socioeconomic and nutrition status; children residing in crowded housing (<242 sq. ft.) had nearly a two-fold higher mortality rates than children residing in less crowded housing (>242 sq. ft.). Children who were below the 65% cut-off of the Harvard weight-for-age standard or below 70% of the Harvard weight-for-height standard experienced about three-fold higher rates of mortality in comparison to their better-nourished counterparts.

MATERIALS AND METHODS

The data for this analysis come from Matlab thana, Comilla district, Bangladesh. Since 1963, the International Centre for Diarrhoeal Disease Research, Bangladesh (formerly the Cholera Research Laboratory) has operated a demographic surveillance system among 228 villages containing a population in 1974 of 276,679. The surveillance system consists of regular cross-sectional censuses and the longitudinal registration of vital events (births, deaths, migrations, and marriages).

The population of the study area is relatively homogenous, consisting of 88 percent Muslims and the rest being Hindus. The average household consists of about 6 persons. The homes have earthen floors with walls and roofs that reflect their economic status. Households consisting of patrilineally related families are grouped in clusters called *baris*, having a common courtyard. Land-holding is skewed, with 18 percent of the households owning 47 percent of the land. About 40 percent of the males over age 15 years as compared to 16 percent of females in the same age group have completed 4 years of schooling. With regard to occupation, about 70 percent of the males and only 6 percent of the females are classified as "economically active". It is, however, recognized that the "housewife" classification masks a significant but unrecognized component of economic productivity in rural Bangladesh.

The field procedures for the collection of the demographic data have been reported in several previous publications*. Enumeration of regular residents of the study population has been undertaken periodically, the last in 1974.

* These field procedures were in operation during this study (1974-1977). The data collection system has undergone subsequently in 1978 minor modifications. (Ruzicka and Chowdhury, 1978).

The longitudinal registration of vital events involves over 300 full-time workers organized into a four-tier field structure. Detection of vital events at the village level is the responsibility of 290 female village workers (called *dais*), many of whom are illiterate. These village workers, responsible for an average of 200 households each, visit each household weekly and enquire about vital events. Events are entered in a village registry book, often maintained with the help of literate relatives or friends. Female village workers are supervised in turn by 16 male field assistants who have matriculate (high school) education and practical field training. Each field assistant supervises about 16 female workers and covers a population of 16,000. Field assistants, accompanied by the female worker, visit each household monthly to check on the completeness of the registration and to record vital events on standard reporting forms. The work of the field assistants is again checked by 4 senior field assistants who visit each household at least three times annually. These workers are supervised finally by a supervisor and 3 assistant supervisors who, through random field visits, check on the quality and completeness of the registration system.

This paper presents demographic surveillance data over the period 1974-1977. Several specific features of these data deserve mention. First is age reporting. Since the Matlab demographic surveillance system has been operating for over a decade, the precise age of children under age 12 is known with accuracy. Second is the diagnosis of cause of death. Field assistants do not have formal medical training - thus the diagnosis may be flawed and should be interpreted with caution. Third is the disturbances associated with flooding and food shortage in 1974 and 1975. Death rates were abnormally high during these 2 years and are thus not necessarily reflective of normal periods.

Mortality data for the years 1974 through 1977 are matched with 1974 SES data of individuals and households. Since 1974 was a year of crisis, shifting of ownership and economic status took place during the period 1974-75. A small survey taken in 1976 indicated that care should be taken in using the SES data of 1974 since patterns had changed during the years since the census was taken (Huffman *et al.* 1976).

With regard to the age-specific mortality rates some problems exist in linking mortality of infants and children under 5 to SES data. Successive years 1975, 1976 and 1977 would exclude respectively deaths up to age 0, 1 and 2 respectively as the 1974 cohort is followed over time. The introduction of the births, deaths and migration components at these ages have been done. Matching of infants (age 0) has been a particular problem which has not been resolved with the limited computer facilities in Dacca. Work on this area is continuing. The results presented here are restricted to data from Matlab. In the discussion, other studies are compared with these findings.

These data will be studied from tapes now being cleaned at the Johns Hopkins University, U.S.A. Unfortunately they were not available for the present paper.

RESULTS

Table 1 provides a broad profile of the SES characteristics of the population in the study area, enumerated at 276,679 persons in 1974. The various indicators are grouped under three headings - education, occupation and ownership. Some of the items under ownership are understood in a broad sense since "sources of drinking water" and the "use of a fixed latrine" are not necessarily identified with a specific owner.

Education levels are characterized by the number of years of schooling. Three classes are provided - no schooling or maktab (elementary religious education only), one to six years and finally those who have studied seven or more years. Only 12.3 percent of household heads belong to 7+ groups whereas more than fifty percent are in the no schooling group. If one considers the highest education attained by any individual in the family the breakdown is more evenly distributed - 23.8 percent have no schooling and 31 percent are in the 7+ group.

With regard to occupation, only 4.1 percent of household heads are classified as landowners. These persons represent a privileged group in the study area and support themselves and the families from the produce of their land without having to work themselves. At the other end of the scale are the agricultural labourers with no land except perhaps the small courtyard around their dwelling unit. 19.6 percent of household heads fall into this class. The largest group of household heads - nearly 70 percent - constitute an intermediate group mainly of landowner - workers and persons employed against wages.

Several items relating to ownership were enumerated in the 1974 census. Tin structures are the most costly and only around eight percent have them. Nearly 20 percent have houses built with mud walls. Area of dwellings is not necessarily a criteria of social status especially if families are large and members additional to the nuclear family stay in one dwelling. However, the fact that over 26 percent of the household heads have, as residential area less than 169 sq. feet, speaks volumes about the poor condition of this group since the average family size is 5.8. Some of the items like "sources of drinking water" refer to "main source" and hence inferences from such classification with regard to mortality are not easy. Questions regarding possessions show a striking 30.8 percent who do not have small items like quilts and hurricane lamps. Remittances and possessions of such articles as a watch are considered signs of relative wealth and around 30 percent are in this category. The use of the fixed latrine is a high 82.6 percent but the requirements to be in this category were low. The instructions to interviewers were in order to be considered a fixed latrine there must be a minimal structure such as a bunch of leaves and branches or a log. The overall picture of the socioeconomic level of the Matlab community from these results is, that apart from a small group less than 10 percent of relatively rich persons, most of the rest live in less than modest circumstances. In particular, at least twenty percent of the population could be classified as extremely poor on all the criteria of education, occupation and ownership considered.

TABLE 1

PERCENTAGE DISTRIBUTION OF 1974 POPULATION (BOTH SEXES) BY DIFFERENT SES CHARACTERISTICS

SES Characteristic					
Education	No Schooling + Maktab	1-6 Years	7+ Years		Total (N=276670)*
Household Head	53.7	34.1	12.3		100.0
Highest in family	23.8	45.2	31.0		100.0
Occupation	Land Owner	Owner Worker etc.	Agricultural Labourer	Others	
Household Head	4.1	69.6	17.6	8.8	100.0
Ownership Structure of House	Tin	Tin and Others	Others		
	8.5	71.7	19.8		100.0
Area of dwellings (in sq. feet)	<169	170-242	243+		
	26.7	23.6	49.7		100.0
No. of boats	0	1	2+		
	46.1	48.0	5.2		100.0
No. of cows	0	1-2	3+		
	51.4	26.3	22.3		100.0
Articles personal	Have nots	Have quilt & hurricane	Remittances watch, etc.		
	30.8	40.8	28.4		100.0
Sources of drinking water	Tubewell	Tanks	Others		
	32.0	33.5	34.4		100.0
Use of fixed latrine	Yes	No			
	82.6	17.4			100.0

* Number of persons in study area

** Number of household heads consists of 40,016 males and 5,014 females

Education

In this section mortality rates of children aged 1 to 4 years are considered in relationship to the two educational indicators presented in Table 1 viz. the education of the household head and the highest education of any member of the family. These data are available for each of the years 1974 through 1977. Bangladesh went through a period of acute shortage of food and other commodities towards the end of 1974 and through 1975. The impact of this crisis has resulted in increased mortality levels for the year 1975.

Table 2 shows the mortality rates of children by education of household head. Three levels of education have been considered as before. At all educational levels, there is a peak in mortality rates for 1975, while 1977 rates are fairly similar to those of 1974. If one considers mortality rates for particular years one notices a steady decline with increasing education. The ratio of mortality rates at the lowest education level to the highest (I:III) is over 1.70 for all four years though a slight decline in this ratio is noticed with time.* Of note, too, is the fact that during the crisis year of 1975 the mortality rates at the lowest and highest education levels are 44.6 and 23.3 respectively. The higher level groups cope better under stress conditions.

TABLE 2

MORTALITY RATES (PER 1000) FOR BOTH SEXES IN MATLAB, BANGLADESH BY EDUCATION (YEARS OF SCHOOLING) OF HOUSEHOLD HEAD FOR THE AGE GROUP 1 - 4 YEARS (1974-1977)

	Education of Household Head (Years of Schooling)	1974	1975	1976	1977
I	0 (No schooling + maktab)	27.3	44.6	37.3	26.0
II	1 - 6	21.2	33.9	27.9	19.0
III	7 +	12.0	23.3	21.4	15.1
I:III		2.28	1.91	1.74	1.72

* Under usual statistical assumptions, the differences in mortality rates at educational levels I and III are highly significant ($t=7.437$, $p<01$, d.f.=3).

Table 3 considers as educational indicator the highest level of education in family measured by years of schooling. These results trace the same patterns for mortality rates as noted previously, the ratio I:III being even higher - over 1.90.*

TABLE 3

MORTALITY RATES (PER 1000) FOR BOTH SEXES IN MATLAB, BANGLADESH BY THE HIGHEST EDUCATION (YEARS OF SCHOOLING) IN THE FAMILY FOR THE AGE GROUP 1 - 4 YEARS (1974-1977)

	Highest Education in the Family (Years of Schooling)	1974	1975	1976	1977
I	0 (No schooling + maktab)	34.7	54.6	42.3	33.9
II	1 - 6	24.0	36.3	32.3	21.4
III	7 +	11.3	26.2	22.3	13.4
I:III		3.07	2.08	1.90	2.53

* Significance tests show that the differences between mortality rates at educational level I and III are highly significant ($t=11.976$, $p<.001$, $d.f.=3$).

It has been noted elsewhere (Caldwell, 1979) that education of mothers is an important indicator for mortality levels. Matching of deaths with educational levels of mothers could be done on a restricted basis only with regard to children who died between the ages one and three for the years 1975 through 1977. These results are presented in Table 4. The same negative relationship between increasing education and mortality levels is noted, though the ratio I:III is now as high as 5.3.

TABLE 4

MORTALITY RATE (PER 1000) FOR BOTH SEXES IN MATLAB, BANGLADESH BY EDUCATION (YEARS OF SCHOOLING) OF MOTHERS FOR THE AGE GROUP 1-3 YEARS (1975-1977)

	Education of Mother (Years of Schooling)	1975 - 1977
I	0 (No schooling + maktab)	33.3
II	1 - 6	20.2
III	7 +	6.3
I:III		5.3

Table 5 considers mortality rates of adolescents, adults 15-44, and adults over 45 years in relation to the education of the household head. The general pattern noted for children is maintained. The ratio I:III of mortality rates remains high for all the age groups and for each of the four years 1974 to 1977, though the differences appear too narrow for the year 1977. Statistically significant differences between the mortality rates at level I and level III are likewise noted. The differences between levels II and III are less marked. In fact for the age group 45+, in 1976 the mortality rates for level II is 24.2 as against 24.7 for level III. This could be due to a selection effect in 1975 - the high mortality year - when the differences in rates between Group II and Group III rose to 6.5 in 1975 as against 5.6 in 1974. A difference of 6.0 is again noted in 1977.

TABLE 5

MORTALITY RATES (PER 1000) FOR BOTH SEXES IN MATLAB, BANGLADESH BY EDUCATION (YEARS OF SCHOOLING) OF HOUSEHOLD HEAD, 1974-1977

	Education of Household Head (Years of Schooling)	1974	1975	1976	1977
		Age Group: 5-14 Years			
I	0 (No schooling + maktab)	3.0	3.6	3.8	2.4
II	1 - 6	2.2	3.3	2.2	1.9
III	7 +	1.7	2.0	0.9	2.0
I:III		1.8	1.8	4.2	1.2
		Age Group: 15-44 Years			
I	0 (No schooling + maktab)	2.5	4.8	2.5	2.2
II	1 - 6	1.9	3.3	2.2	2.1
III	7 +	1.4	3.0	1.0	1.6
I:III		1.79	1.60	2.50	1.38
		Age Group: 45+			
I	0 (No schooling + maktab)	22.9	50.9	28.2	23.9
II	1 - 6	19.8	38.8	24.2	25.2
III	7 +	14.2	32.2	24.7	18.2
I:III		1.61	1.58	1.14	1.31

The conclusions one may draw at this stage is that education levels are important in the understanding of differentials in mortality rates. While, for practical purposes, the education of the head of household is sufficient to identify the groups more susceptible to death, the use of the education by the mother may in fact be a more sensitive indicator and should be utilized especially where young children are concerned. Stratification by highest education of any family member could also be useful but requires more intensive data collection and tabulation.

Occupation

Occupational criteria of household heads have been considered at three levels. At the lowest socioeconomic level (I) are the agricultural labourers and at the highest level (III) are the landowners. In between, at level II, are owner/workers as well as a wide variety of occupations.

Table 6 shows mortality rates for children between ages one and four years for various levels of occupation. As in the case of education, mortality rates show declines with increasing socioeconomic status. As before, rates for 1975 show the effects of crisis and the lowest level economic groups pay the highest price in terms of mortality. The peak for group III appears in 1976. The ratios I:III remain higher than 1.9 for the four years under consideration.

TABLE 6

MORTALITY RATES (PER 1000) FOR BOTH SEXES IN MATLAB, BANGLADESH BY OCCUPATION OF HOUSEHOLD HEAD FOR THE AGE GROUP 1-4 YEARS (1974-1977)

	Occupation of Household Head	1974	1975	1976	1977
I	Agricultural Labourer	35.3	57.9	43.9	31.3
II	Owner worker, etc.	21.0	35.7	29.5	21.2
III	Land Owner	18.0	14.5	21.7	8.8
I:III		1.96	3.99	2.02	3.56

The differences of rates for levels I and III are highly significant ($t=4.5$, $p<.01$, d.f.=3).

Table 7 shows mortality rates for young adolescents between ages 5 and 14 and those for adults between 15 and 44 years. The mortality patterns are similar to those described earlier. The rates for levels I;III are higher than unity for all 4 years (1974 through 1977). The differences between rates at levels I and levels III remain significant for both age groups, 5-14 years and 15-44 years.

TABLE 7

MORTALITY RATES (PER 1000) FOR BOTH SEXES IN MATLAB, BANGLADESH BY OCCUPATION OF HOUSEHOLD HEAD, 1974-1977

	Occupation of Household Head	1974	1975	1976	1977
		Age Group: 5 - 14 Years			
I	Agricultural Labourer	3.5	3.2	4.3	3.6
II	Owner worker, etc.	2.5	4.6	2.0	1.9
III	Land Owner	2.4	2.1	2.1	1.5
I:III		1.5	1.5	2.0	2.5
		Age Group: 15 - 44 Years			
I	Agricultural Labourer	2.8	5.7	3.6	2.4
II	Owner worker, etc.	1.9	3.5	2.0	2.1
III	Land Owner	2.7	3.2	1.2	1.7
I:III		1.04	1.78	3.0	1.41

The consideration of the mortality rates of persons over age 45 in Table 8 shows that differences between levels I and III are less marked and even reversed in 1974 and 1977. Agricultural labourers still bear the brunt of crisis situations. Mortality rates for this group in 1975 reaches 69.6, whereas for levels II and III they are 35.3 and 44.1. An interesting feature of this table is that level II rates fall below level III rates for all four years 1974-1977. Reasons for these differences are under study. One can speculate that a selection effect has taken place in earlier years and survivors in levels I and especially level II are selectively more robust as compared to those in level III. Further, group II comprises a variety of occupations, some of which may provide similar economic security after age 45+ as ownership of land.

In fact these results are significantly different in favour of level II ($t=4.4$, $p<.01$, d.f.=3).

TABLE 8

MORTALITY RATES (PER 1000) FOR BOTH SEXES IN MATLAB, BANGLADESH BY OCCUPATION OF HOUSEHOLD HEAD FOR THE AGE GROUP 45+ YEARS (1974-1977)

	Occupation of Household Head	1974	1975	1976	1977
I	Agricultural Labourer	18.6	65.6	29.9	23.4
II	Owner worker, etc.	16.2	35.3	20.4	21.7
III	Land Owner	19.9	44.1	24.0	26.8
I:III		0.93	1.49	1.25	0.87

Ownership

In this section two criteria of ownership are considered - area of dwellings of households and the number of cows owned. The 1974 census on SES did have several other items as indicated earlier. For our purposes the two items mentioned above provide sufficient evidence that mortality rates are inversely correlated with levels of ownership.

The area of dwellings is divided into three groups. In group I the residential area is less than 169 square feet. In group II the residential area ranges from 170-242 square feet. Group III consisted of households owning 242 or more square feet of residential area. Table 9 shows that the levels of child mortality are nearly twice as high for group I as compared to group III.

TABLE 9

MORTALITY RATES (PER 1000) FOR BOTH SEXES IN MATLAB, BANGLADESH BY AREA OF DWELLINGS OF HOUSEHOLDS FOR THE AGE GROUP 1-4 YEARS (1974-1977)

	Area of Dwellings (in sq. ft.)	1974	1975	1976	1977
I	<169	33.1	52.7	36.9	30.5
II	170 - 242	24.7	39.7	33.7	26.7
III	243+	16.4	28.9	28.5	15.7
I:III		2.02	1.82	1.29	1.94

These differences between groups I and III are statistically highly significant ($t=5.025$, $p<.01$, $d.f.=3$).

If one considers the number of cows owned and mortality rates in Table 10 one notices the same pattern. Group I consists of households owning no cows, Group II households have 1 or 2 cows whereas Group III households have 3 or more cows. The mortality rates of children in Group I are over 25 per 1000 for the 4 years 1974-77 whereas those for Group III are under 25 for 1975 and 1976 and are around 15 per 1000 in the years 1974 and 1977. The mortality rates for 1975 and 1976 in Group I are as high as 46.4 and 35.8 respectively.*

TABLE 10

MORTALITY RATES (PER 1000) FOR BOTH SEXES IN MATLAB, BANGLADESH BY NUMBER OF COWS OWNED BY HOUSEHOLDS FOR THE AGE GROUP 1-4 YEARS (1974-1977)

	No. of Cows Owned	1974	1975	1976	1977
I	0	27.9	46.4	35.8	25.2
II	1 - 2	20.6	33.1	31.2	22.8
III	3+	15.0	24.6	24.5	14.8
I:III		1.86	1.89	1.46	1.70

* Differences between rates in Group I and III are highly significant (t=5.39, p<.001, d.f.=3).

Patterns of mortality for the age groups 5-14 years, 15-44 years and persons over 45 years of age are similar to those described earlier in this section. Area of dwellings appears to differentiate more sharply in Groups I and III than the corresponding groups when ownership of cows is considered.

TABLE 11

MORTALITY RATES (PER 1000) FOR BOTH SEXES IN MATLAB, BANGLADESH BY AREA OF DWELLINGS OF HOUSEHOLD, 1974-1977

	Area of Dwellings (in sq. ft.)	Age Group: 5-14 Years 1974	1975	1976	1977
I	<169	3.9	4.8	4.5	2.8
II	170 - 242	2.7	3.4	3.1	2.3
III	243 +	1.8	2.4	1.8	1.7
I:III		2.2	2.0	2.5	1.6

TABLE 11 (Contd.)

	Area of Dwellings (in sq. ft.)	1974	Age Group: 15 - 44 Years 1975	1976	1977
I	<169	3.3	5.6	2.7	2.7
II	170 - 242	1.8	3.9	2.3	2.1
III	243 +	1.6	3.1	2.0	1.7
I:III		2.06	1.81	1.35	1.59
			Age Group: 45+ Years		
I	<169	28.3	58.9	29.8	23.6
II	170 - 242	21.3	51.5	27.0	24.0
III	243 +	17.5	35.8	24.8	23.6
I:III		1.62	1.65	1.20	1.00

TABLE 12

MORTALITY RATES (PER 1000) FOR BOTH SEXES IN MATLAB, BANGLADESH BY NUMBER OF COWS OWNED BY HOUSEHOLDS, 1974-1977

	No. of Cows Owned	1974	Age Group: 5 - 14 Years 1975	1976	1977
I	0	3.2	3.9	3.2	2.6
II	1 - 2	2.0	2.5	2.6	1.9
III	3+	1.7	2.8	2.3	1.5
I:III		1.9	1.4	1.4	1.7

TABLE 12 (Contd.)

	No. of Cows Owned	1974	1975	1976	1977
		Age Group: 15 - 44 Years			
I	0	2.7	4.8	2.5	2.2
II	1 - 2	1.7	3.2	2.1	2.2
III	3+	1.6	2.9	1.8	1.5
I:III		1.69	1.66	1.39	1.47
		Age Group: 45+ Years			
I	0	25.2	54.5	29.8	26.1
II	1 - 2	19.6	39.2	25.1	22.6
III	3+	13.4	31.4	21.3	19.9
I:III		1.88	1.74	1.40	1.31

As hygienic practices are related to both mortality and social status, mortality rates for the years 1974-77 were tabulated for users, non-users of fixed latrine facilities. For all age groups considered, mortality rates for non-users of fixed latrines were higher than those of users. These results can be seen in Table 13.

TABLE 13

MORTALITY RATES (PER 1000) FOR BOTH SEXES IN MATLAB, BANGLADESH BY USE OF FIXED LATRINE IN HOUSEHOLDS, 1974-1977

	Use of Fixed Latrine	1974	1975	1976	1977
		Age Group: 1 - 4 Years			
I	No	28.9	51.0	36.5	23.1
II	Yes	22.2	35.8	31.2	22.0
I:II		1.30	1.42	1.17	1.05

TABLE 13 (Contd.)

	Use of Fixed Latrine	1974	1975	1976	1977
		Age Group: 5 - 14 Years			
I	No	3.4	4.5	4.4	2.9
II	Yes	2.4	3.0	2.5	2.1
I:II		1.4	1.5	1.8	1.4
		Age Group: 15 - 44 Years			
I	No	2.6	5.0	2.9	2.6
II	Yes	2.1	3.7	2.1	2.0
I:II		1.24	1.35	1.38	1.30
		Age Group: 45+ Years			
I	No	25.4	52.4	29.1	24.3
II	Yes	19.8	42.8	25.9	23.5
I:II		1.28	1.22	1.12	1.03

Sex Differentials: Data presented in previous tables have been provided for both sexes. It has been shown elsewhere (D'Souza and Chen 1980) that important sex differentials in mortality exist especially for children under age 5. Some of these results are presented here to provide a broader picture of the type of mortality differentials existent in the Matlab study area. Table 14 presents infant mortality rates by year and sex. The rates for the years 1974 and 1975 stand out sharply against those for 1976 and 1977. It should be noted that since the infant mortality rate relates infant births and deaths within a calendar year, acute disruptions could artificially influence the rate by temporary fluctuations of birth and infant deaths. Differentials by sex do not appear important if one considers the overall infant mortality rates in the 4 study years. However, breakdowns by neonatal and post-neonatal mortality rates present a very different picture. Neonatal rates for males are significantly higher than those for females.[1] Conversely, post-neonatal female rates are significantly higher than males rates.[2] Sex differentials of infant

[1] ($p<.05$, $t=2$, d.f.=3). [2] ($p<.05$, $t=2.52$, d.f.=3).

mortality therefore display a reversal from the neonatal to the post-neonatal period. It also appears that the 1974-75 disturbances affected the post-neonatal rates to be a larger extent than neonatal rates.

TABLE 14

INFANT MORTALITY RATES (PER 1000 LIVE BIRTHS) BY YEAR AND SEX IN MATLAB, BANGLADESH (1974-1977)

Age/Sex	Year				
	1974	1975	1976	1977	All
Infants (0-11 months)					
All	137.9	191.8	102.9	113.7	131.2
Male	142.5	165.1	113.6	113.3	130.9
Female	132.9	184.1	110.3	114.2	131.5
Neonatal (<1 month)					
All	78.1	79.9	65.3	71.3	73.0
Male	87.9	81.6	72.0	73.1	78.2
Female	67.8	78.1	58.1	69.4	67.6
Post-neonatal (1-11 months)					
All	59.8	111.9	37.6	42.4	58.2
Male	54.6	98.4	33.3	40.2	52.6
Female	65.1	126.3	42.1	44.8	63.9

Table 15 presents data on 1-4 year child mortality. Higher mortality rates are registered for females than males at every single year through age 4. The excess of the overall rate for the age group 1-4 years is very highly significant for females in comparison to males.[1]

Higher levels of female mortality are maintained in 5-14 year and 15-44 age groups. These differentials are reversed for the age group above 45 years.

For children aged 1-4 years, higher female than male mortality is present at all SES levels. When education of household head is considered, the ratio of female to male mortality in year 1974 is 1.91, 1.59, and 1.33 for the respective education levels I, II and III. Sex differentials in mortality do not however show a consistent pattern. While the year 1974 does show the highest ratios of female to male mortality in the lowest SES group, results for

[1] ($p<.005$, $t=8.75$, d.f.=3).

TABLE 15

CHILD MORTALITY RATES (PER 1,000 POPULATION) BY YEAR AND SEX IN MATLAB, BANGLADESH (1974 - 1977)

Age (years)	Sex	Year				
		1974	1975	1976	1977	All*
1	B	31.6	47.4	48.2	29.9	43.10
	M	22.9	38.4	40.9	23.8	35.23
	F	40.6	56.8	55.9	36.6	51.28
2	B	34.8	38.6	33.0	23.8	32.53
	M	25.7	31.4	29.5	16.1	26.59
	F	44.4	46.1	36.6	32.2	38.80
3	B	22.5	31.7	24.1	18.2	24.36
	M	16.0	26.0	20.4	12.6	19.37
	F	29.2	37.7	28.1	24.0	29.65
4	B	11.6	18.8	15.2	10.5	14.83
	M	7.7	17.2	13.0	8.4	12.86
	F	15.8	20.6	17.5	12.7	16.94
1 - 4	B	25.4	24.9	29.6	19.6	28.43
	M	18.3	28.8	25.5	14.5	23.27
	F	32.9	41.3	33.9	25.2	33.89

* Combines 1975-77 only.

other years do not maintain the same pattern. For the year 1977, for instance, these ratios are 1.57, 1.83, and 2.11 for education levels I, II and III a complete reversal of the 1974 pattern.

DISCUSSION

The results presented show a clear inverse relationship between various levels of mortality and socioeconomic status in the Matlab area. This inverse relationship persists for all the age groups considered: 1-4, 5-14, 15-44 and 45+ years. The parameters utilized for assessing socioeconomic status - years of education of the head of household or mother, occupation, area of dwelling, ownership of cows - were all effective for demonstrating higher mortality rates for the lower social classes. Further, sex differentials in mortality have been shown to be quite substantial.

Results from the Bangladesh Fertility Survey (1975) confirm the findings of the present paper. Using indirect estimation procedures, Mitra (1979) has also shown that an inverse relationship exists between mortality and the following socioeconomic characteristics - parents' education, father's occupation and economic status. Table 16 presents results of estimates of child mortality by educational subgroups of mothers. Similar results are obtained for the other characteristics. Estimation of $q(1)$, $q(3)$ and $q(5)$ are generally considered unaffected by reporting errors than $q(0)$. Using the estimates of $q(2)$, $q(3)$, $q(5)$ implied estimates of $q(0)$ can be obtained from Model Life Tables. Results in Table 17 show that the general pattern of higher mortality for less education of mothers remain true even in the case of infant mortality. Some caution has to be exercised in the conclusions drawn from these results, since an earlier enquiry based solely on infant mortality data in the Matlab area did not show significant differences between the socioeconomic classes (Huffman, 1976). While one can understand that for infants - since they are breast fed - socio-economic differences may play a smaller role, the fact remains that the matching of infant deaths to mothers is not an easy task. In the present study 632 infants deaths (around 15 percent of all infant deaths) could not be matched to their mothers. Further work on mortality in this age group is still being done on data from Matlab.

Results from the Bangladesh Retrospective Survey of Fertility and Mortality 1974 are also consonant with the findings of our study. Among the more important socioeconomic items studied in the survey were education (both women and their husbands) and house type. Table 18 presents levels of educational attainment of women associated with proportions of children dead by age groups. These proportions decrease with increasing years of education. Similar results are obtained if one considers husband's education or house types.

The results on sex differentials reported here differ from results of the Bangladesh Retrospective Survey on Fertility and Mortality. It has been suggested that methodologies depending on retrospective methods may not be

TABLE 16

ESTIMATES OF CHILD MORTALITY BETWEEN BIRTH AND AGE x,q(x) BY EDUCATIONAL SUBGROUPS OF MOTHERS

Educational Subgroups	Estimates of Child Mortality		
	q(2)	q(3)	q(5)
Illiterate	.204 (987)	.235 (865)	.240 (645)
Educated for less than 5 years	.178 (145)	.174 (124)	.186 (77)
Educated for 5 to 8 years	.132 (162)	.127 (126)	.156 (62)
Educated for 9 years or more	.134 (63)	.144 (37)	.062 (18)

Note: Figures within the brackets are the numbers of respondents in each category.

Source: Bangladesh Fertility Survey, 1975.

TABLE 17

IMPLIED INFANT MORTALITY RATE, q(0) BY EDUCATIONAL SUBGROUPS OF MOTHERS

Educational Subgroups	Derived from the Estimates		
	q(2)	q(3)	q(5)
Illiterate	.162 (2278)	.173 (3564)	.160 (645)
Educated for less than 5 years	.142 (328)	.128 (564)	.126 (456)
Educated for 5 to 8 years	.107 (383)	.097 (490)	.108 (350)

Note: (a) Figures within the brackets are the numbersof children ever born to respondents in each category.

(b) Derived from the Coale-Demeny West Model Life Tables; assuming sex-ratio at Birth: 100(M/F)=105.

Source: Bangladesh Fertility Survey, 1975.

TABLE 18

PROPORTIONS OF CHILDREN DEAD BY WOMEN'S EDUCATION

Women's Educational Level	Proportion of Children Dead
0	0.2767
1 - 5	0.2172
6 - 10	0.1653

Source: Bangladesh Retrospective Survey on Fertility and Mortality, 1974.

sensitive to measure such mortality differentials, when sex preferences regarding children exist in a country. Male preferences in parental care etc. are possible determinants of mortality differences and responsible for undercount in female children deaths by recall procedures.

The major importance of this paper is that serious differentials in mortality levels have been documented for various socioeconomic strata in a rural area of Bangladesh - the lowest strata having the highest mortality levels. The inverse relationship between education of mother and mortality rates has been strikingly shown. In the age group 1-3 years the mortality rates are over five times as high for children of mothers having no education as compared to those having 7 or more years of schooling. The vulnerable nature of the lowest SES groups with regard to very high mortality rates during times of crisis have also been shown. Higher SES groups appear to have better capacity to withstand the hardships arising from floods and subsequent shortage of food.

An important question raised but not directly answered is whether unequal distribution of health care is also present. Are the main beneficiaries of the present health care system those who belong to the higher classes? Other studies indicate that this is indeed the case (Claquin, 1980). While it is true that mortality levels are related to a wide complex of factors - including nutritional status and cultural development - government planning will have to ensure widespread and egalitarian distribution of health benefits. The poorest groups should receive adequate attention. Further, in the case of sex differentials, social change in the status and economic role of women may be a critical factor. In the absence of more sexually egalitarian social structures, there may be insurmountable sex biases in child care, food allocation etc. that would nullify inexpensive availability of health technologies.

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