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FEMALE CHILDHOOD MORTALITY
IN RURAL BANGLADESH:
STRATEGIC DISCRIMINATION IN THE CONTEXT
OF GROWING POVERTY

by

Deborah Sunter, B.A., B.Sc.N.

A thesis submitted to the Faculty of
Graduate Studies and Research in partial fulfillment
of the requirements for the degree of
Master of Arts

Department of Sociology and Anthropology

Carleton University

Ottawa, Ontario

September, 8, 1989

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"Female Childhood Mortality in Rural Bangladesh:
Strategic discrimination in the Context of Growing Poverty

submitted by Deborah Wendy Sunter, B.A., B.Sc.N.,
in partial fulfillment of the requirements for
the degree of Master of Arts.

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ABSTRACT

Data pertaining to a 1982 birth cohort from Matlab, Bangladesh, are analysed to test the thesis that excess female mortality in the first months of life arises from deliberate and selective behaviour by parents. This selectivity has strategic value for family welfare in a society which is both rigidly patriarchal and increasingly competitive. The findings suggest that sex-differentials are emerging in the neo natal and early infant months, substantially earlier than reported for a 1973 cohort from the same area. In addition, birth order affects differential mortality. Whereas the presence of same-sex siblings is associated with decreased mortality for males, aged 0-54 months, it is associated with increased mortality for females, regardless of socio-economic status. More significantly, excess female neo natal and early infant mortality is associated with the presence of older sisters. These findings support the thesis that early excess female mortality is selective and strategic.

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D.S.

TABLE OF CONTENTS

	Page
1. INTRODUCTION.....	1
2. THEORETICAL PERSPECTIVES.....	2
3. THE HOUSE-HOLD LIFE CYCLE AND FAMILY BUILDING STRATEGIES.....	7
3.1 LIFE-CYCLE AND ECONOMIC WELFARE.....	10
3.2 STRATEGIES OF SURVIVAL AND CLASS POSITION.....	11
3.3 FEMALE CHILDHOOD MORTALITY: a STRATEGY FOR FAMILY WELFARE.....	16
3.4 HYPOTHESES.....	21
4. DATA ANALYSIS.....	23
5. DISCUSSION AND IMPLICATIONS.....	42
REFERENCES.....	45
6. APPENDIX A: The Impact of Out-Migration.....	49

LIST OF TABLES

	Page
3.1 AVERAGE DISTRIBUTION OF HOUSEHOLD EARNINGS BY FAMILY MEMBERS IN TWO RURAL DISTRICTS, BANGLADESH, 1983.....	15
3.2 OWNERSHIP OF LAND OF FAMILIES OF CHILDREN BORN BETWEEN JULY AND DECEMBER, 1982, MATLAB.....	20
4.1 SELECTED DEMOGRAPHIC CHARACTERISTICS OF BIRTH COHORT BORN JULY-DECEMBER, 1982 MATLAB, BANGLADESH.....	24
4.2 INFANT AND CHILD MORTALITY RATES BY AGE AT DEATH AND BY SEX, 1974-77 AND 1982, MATLAB.....	25
4.3 CUMULATIVE LIFE-TABLE PROBABILITIES OF INFANT AND CHILD MORTALITY BY SEX FOR COHORTS BORN 1982, 1973-73 AND 1966-73, MATLAB.....	26
4.4 DEATH RATES FOR AGES 0-54 MONTHS BY SELECTED SOCIO ECONOMIC CHARACTERISTICS OF HOUSEHOLD AND BY SEX, 1982 COHORT MATLAB.....	30
4.5 CHILD MORTALITY BY BIRTH ORDER BY SEX 1982 COHORT, MATLAB.....	32
4.6 CHILD MORTALITY RATES BY SIBLING STATUS AND SELECTED HOUSEHOLD CHARACTERISTICS, 1982 COHORT.....	33
4.7 CUMULATIVE PROPORTION OF INFANTS AND CHILDREN DYING BETWEEN 0-54 MONTHS BY SEX AND PRESENCE OF SAME-SEX SIBLINGS, 1982 COHORT, MATLAB.....	37
4.8 DEATHS BY AGE IN MONTHS, SEX, AND PRESENCE OF ABSENCE OF OLDER SAME SEX SIBLINGS.....	40
6.1 AGE-SEX SPECIFIC DEATH RATES (INCLUDING OUT-MIGRANTS).....	50

LIST OF FIGURES

	Page
4.1 ESTIMATED CUMULATIVE PROPORTION OF CHILDREN DYING BY SEX, AND COHORT.....	28
4.2 MORTALITY RATE BY BIRTH ORDER BY SEX 1982 COHORT.....	32
4.3 CUMULATIVE PROPORTION OF CHILDREN DYING, BY SEX BY SAME-SEX BIRTH ORDER.....	38

"If one has many sons it is expected that they will pray to God and thus glorify Him" [p.99]

"The main objective of marriage is to ensure continuity of one's lineage through procreation. The offspring will keep alive the name and identity of the parents" [p.100]

"A greater number of people is a source of strength in the village. He who has many sons is more powerful. Because of this belief many people desire many sons" [p.101]

"More than one son is appropriate for old age security; if there is only one he might die or be unwilling to provide it " [p.104]

"A male child is favored. If the males in a family are few then the size of the "lineage segment (bangsa) becomes small. Males are future earners, but females are economically unproductive. Parents have to spend a lot on arranging marriages of daughters. So for economic reasons a male child is preferred" [p.107]

"Nowadays a girl child is viewed as a problem in the family. If parents could control the sex of children born then every couple would decide to have a male child first. A son is essential for continuity of the lineage and old age security. The dowry system has turned the females into a sort of commodity, and a couple feels frustrated if they have three daughters in succession" [p.107]

"I have five daughters and two sons. If all seven children were sons there would be no complaint. My daughters create problems because for the arrangement of their marriages a huge amount of money is needed." [p.107]

Quotes from village respondents cited in Maloney,C, Aziz, KNA, Sarker,p, "Beliefs and Fertility in Bangladesh", 1991, ICDOR,B, Dhaka. p.99

CHAPTER 1

INTRODUCTION

In most regions of the world neo-natal, infant, and child mortality rates are higher for males than females. South Asia, including Bangladesh, has long been noted an exception to this pattern in the infant and childhood years (El Badry, 1969).

In the absence of adequate biological explanations for this anomaly, social scientists have concerned themselves with finding the behavioral mechanisms which contribute to excessive female childhood mortality, and the underlying causes for such behaviours.

This paper joins the theoretical and empirical debate at both levels. Socio-economic and demographic data from a longitudinal study of a 1982 birth cohort in Matlab, Bangladesh, provide a basis for comparison with the findings of other investigators and an opportunity to test hypotheses developed in this paper. It will be argued that deteriorating socio-economic conditions compel families to develop family building strategies in order to compete for increasingly scarce resources. Successful competition usually depends on the timely birth and continuing health of sons, and minimizing the liability represented by daughters. Far from being generalized and undirected, excess female mortality in the first few months of life is probably selective and deliberate.

CHAPTER 2. THEORETICAL PERSPECTIVES

In the 70's, several studies were conducted in the Matlab area with particular relevance for understanding sex differentials in childhood mortality. A study of sex-bias in the allocation of food and health care found that females suffered from a greater degree of acute and chronic malnutrition than males of the same age [Chen et al, 1981]. The researchers also investigated patterns of food allocation within households and found little evidence of sex-based discrimination during the first few months of life when breast feeding is the only source of nutrition.

However, they did find evidence of discrimination at the time of weaning which typically begins around the age of eight months. Although prolonged breast feeding is almost universal in Bangladesh [Arthur and McNicoll, 1978:54] and often extends past 18 months, weaning refers here to the addition of non-breast milk foods to the infant's diet. At this time male infants were more likely to receive supplementary foods such as cereal and dairy products. Female infants were less likely to receive supplements, and when they did, these were watered down.

An investigation of the disease experience of these children did not support the hypothesis of sex differentials in type or frequency of illness. However, Chen et al did find striking sex differentials in the attendance of children at medical clinics. Although treatment was free, 66% more male children than female children between the ages of 0 and 4 were brought to clinics for

care [Chen et al, 1981:64].

The findings of this study provided strong support for the hypothesis that sex-based discrimination in the allocation of food and health resources within the family was a major mechanism in sex-differentiated mortality.

Further support was added to this thesis by Koenig and D'Souza [1986] in their analysis of mortality data pertaining to a 1973-74 Matlab birth cohort. At the end of the five year study period, the authors compiled information on the cumulative proportion of children dying at specified age intervals, by sex.

They found that the cumulative proportion of males dying exceeded that for females until the age of about 15 months. At that age, the proportion of females who had died overtook that of males and remained higher for the rest of the study period. This pattern reflected the emergence of consistently higher female than male mortality rates after the eighth month.

The timing of this higher female mortality "coincides with the period when breastfeeding by itself becomes inadequate to meet nutritional demand" [1986:19]. It appears, therefore, that a major mechanism of excessive female mortality in infancy is sex-biased differentiation in the allocation of adequate quality and quantity of supplementary weaning foods.

The authors suggest that their findings also support the larger thesis that general cultural bias against females legitimizes discrimination against them when family resources are scarce.

Economic pressures force parents to selectively distribute limited resources such as food, clothing and medical care to offspring...in light of the very strong preferences for sons in such societies it is likely that the sex of the child may often be a central consideration...viewed from this perspective cultural factors related to son preference come into play largely in response to economic pressures which necessitate the selective distribution of familial resources" (Koenig and D'Sousa, 1986:20)

The 1974 cohort data appear to support the argument that females lose to their brothers in the competition for post-weaning food. There is, however, a problem with the suggestion that this behaviour arises as a response to shortages of familial resources. If this were the case there should be some evidence of socio-economic differentiation. That is, in families with adequate means of support, cumulative female childhood mortality rates should be lower than those for males. However, Koenig and D'Sousa report that sex differences in childhood mortality persisted even among families that were more educated and presumably more economically advantaged. They are unable to explain this lack of class differentiation but suggest that SES differences in Matlab may be so slight as to be insignificant. This explanation is inconsistent with the negative correlation between overall rates of childhood mortality and size of landholdings, reported for the Matlab area during the same period (D'Sousa et al, 1988:20).

There is other evidence that early female mortality which is in excess of male mortality cannot be adequately explained by the existence of intrafamilial shortages leading to sex-biased

allocation of nutritional resources. A study of the Matlab area by Ruzicka and Chowdhury [1978] found that the female to male mortality ratio of children aged 1-4 rose sharply during the famine of 1974-75 to 1.8 from 1.5 in 1971-72 and 1.3 in 1966-69. During this famine the number of children with third degree malnutrition (those at less than 60% of weight for age) exceeded 25%. On further study of the data, Bairagi [1986] found that, although all children of the lower socioeconomic group suffered disproportionately, female to male nutritional differences were consistently higher among children of higher socioeconomic status [1986:310].

Other studies question the causal connection between nutritional and mortality differentials. Findings of anthropometric differences between male and female children do not always correspond to mortality differences [Harris and Watson, 1987:97, Basu, 1989:197, Das Gupta, 1987]. Basu, in particular, argues that differential health care is the more plausible mechanism of mortality differentiation.

While the relative importance of malnutrition and health care as causal mechanisms in differential mortality continue to be studied and debated, Das Gupta, [1987] emphasizes another dimension of differential mortality. She argues against the assumption implicit in the work from Matlab that discrimination against females is generalized and undirected. Data from the Punjab indicate that there is a selective and deliberate process involved. She found a positive relationship

between higher order female births and higher female to male mortality ratios. Furthermore, the sex differentials by same-sex birth order were stronger than those by socio-economic status of the family.

Das Gupta concludes that sex discrimination as reflected in differential mortality rates should be seen at the household level as a "deliberate family building strategy", in response to women's structural marginalization. This marginalization is created by the social organization of economic activity, ownership, and control which decreases the value of daughters relative to sons. Although the cultural and economic circumstances are different from those in relatively affluent, Hindu, Punjab, there are compelling reasons why female infant mortality might be of strategic value to families in rural Bangladesh. This argument is developed in the following chapter.

CHAPTER 3. THE HOUSEHOLD LIFE-CYCLE AND FAMILY BUILDING STRATEGIES

In 1978, Cain demonstrated the rationality of the high fertility found in rural Bangladesh by analysing the interplay between the life cycle of a household, and its chances for economic stability and upward mobility, in the context of competition for increasingly scarce resources. His analysis also helps explain the excess female childhood mortality.

Two major factors make it reasonable to define the life-cycle of a family as beginning when a young man establishes a household separate from that of his parents, thus becoming a patriarch, and ending at his death. First, the kinship, political, and economic institutions of Bangladesh are thoroughly patriarchal. Marriage, which typically occurs at the age of 14 or 15 for females and the early or mid twenties for males, is patrilocal, with no financial and limited social obligation to the wife's family. Ownership and inheritance of land generally falls to sons. Activity which is socially defined as productive is limited to males as women are constrained by the practice of purdah to social and productive activities within the confines of the homestead. A rigid division of labour and strict control over family resources and decisions by the patriarch create a situation of total dependency for women. Second, although agnatic kinship is the over-riding principle of social organization, the family as an independent economic unit is usually nuclear, consisting of husband, wife, and children. The extended family,

comprising more than one generation of married couples, is increasingly rare, and associated mainly with wealth. However, even in wealthy families sons usually establish a separate household shortly after marriage [Cain, 1978:422].

The rural Bangladeshi family is not only a reproductive unit. Typically it is a relatively self-contained economic unit of production and consumption. The production opportunities, and hence the family's survival (both in terms of the unit itself and the individual members) depends on the labour opportunities of each of its members. This will be conditioned by the class position of the household and the sex and age composition of its members.

Several major events will not only characterize the evolution of the household, but contribute to its economic welfare, as well as the future welfare of those who survive the patriarch.

First, the spousal union which usually occurs at the beginning of the life-cycle may be severed through divorce or abandonment. Divorce can be devastating to the fortunes of the wife and it is most often in her interests to remain in the marriage. On the other hand, divorce does not appear to be a major threat to the patriarch. Most occur in the early years of marriage, and wives can easily be replaced [Cain, 1978:429]. As the definition of the household life-cycle is contingent on the patriarch and not the wife, divorce is usually only a temporary source of uncertainty. Indeed, it may result in increased property, as the husband usually retains the dowry from the first union and negotiates another from the second.

Adult mortality can radically alter the family life cycle. As in the case of divorce, if a mother dies the disruption is often only temporary as she can be easily replaced. However, the death of the patriarch not only signals the end of this particular household cycle, it can also radically alter the fortunes of the surviving family members. The timing of the patriarch's death interacts with fertility factors in its effect. The family must be able to replace the loss of the patriarch's labour power. It must also be able to maintain control of the family holdings. Children can be disinherited in an extended household if their father's death precedes that of his father. The family property will fall to the dead man's siblings. In the case of the nuclear family, the early death of a father, before sons are old enough to take control, often results in loss of family holdings and eventual destitution [Cain, 1978]. Due to the large age disparity between most couples, widowhood is very common. The only source of security for most widows is in bearing sons who remain healthy into adulthood.

Finally, factors of fertility and mortality of offspring are a crucial source of uncertainty in household evolution. Perhaps because infertility not only threatens the continuance of the kin line, but also the viability of the family, it is an acceptable reason for divorce [Cain, 1978:42, Maloney, 1981:80]. In Bangladesh, total fertility is high, but so too is fetal, infant and childhood mortality. For women aged 45 and over who delivered live births in 1982 in Matlab, the mean number of previous pregnancies was approximately 8, and the mean number of surviving children

(excluding this birth) was approximately 5.6 [ICDDR,B, 1982:29]. Over a fifth of children born do not live past five years [Koenig and D'Souza, 1986:16].

The sex and sex ordering of children at birth is beyond control of parents. However, the family may have good reason to influence the sex ordering and composition through additional fertility and through behaviours which selectively influence children's mortality. The motivation is the economic viability of the household and the welfare of each of its members. "Not only number of living sons, but also timing of male births may be a significant factor in the economic welfare of the family" [Cain, 1978:424].

3.1 LIFE-CYCLE AND ECONOMIC WELFARE

Cain argues that the economic viability of a Bangladeshi family is more closely linked to its "demographic evolution" than in most other societies, developed or not. A complex of conditions specific to Bangladesh contributes to this link.

Extended households are not the norm. Although the nuclear household is typically contained within the framework of an agnatically related grouping, called a bari, each patriarch has economic control of and responsibility for his household [Cain, 1978:422]. The obligations and responsibilities of kinship still operate, but increasing impoverishment and competition have seriously compromised the support system that kinship used to represent, and there are no formal support networks to replace it.

There are few production opportunities outside of agriculture in most rural areas. The type of crop and the extremely small and fragmented plots have not encouraged mechanization. Farming is, therefore, highly labour intensive. However, a rigid division of labour prohibits women from working in the fields.

The overall fortunes of the rural population are crumbling into massive poverty. Through the generations, high birth rates have meant the subdivision of family holdings into ever decreasing areas. The sheer density of the population requires increasing use of land for homesteads instead of cultivation. Natural disasters such as drought and flooding are frequent, and may be becoming more intense in their destructive capacity.

The family, as a unit of production and consumption, must find ways to combat the problems outlined above. Although class position will alter the possibilities, families from all classes will require a strategy. Elements of the household life-cycle itself contain strategic value in combating these threats.

3.2 STRATEGIES OF SURVIVAL AND CLASS POSITION

As stated above, poverty is increasing in Bangladesh, both in absolute and relative terms. Although there are small numbers of professionals and merchants whose economic standing is not connected with agriculture, the vast majority of household economic activity is agricultural. Landownership is, therefore, a useful measure of socio-economic status. Ownership and control of land is highly skewed and there are definite indications that polarization of

wealth is a continuing trend.

Family labour power is crucial to the welfare of the landless and landed alike in the struggle to gain or retain a share of resources which are so inequitably distributed. Families with sizeable holdings will require high concentrations of agricultural labour power at peak periods of the year. The expense of hiring outside labour when cash flow is a constant problem may precipitate a crisis and the eventual sale of land. The value of family labour outweighs its costs [Caldwell, 1982:360; Westergaard, 1983:18]. Family labour is even more crucial for households that do not own land but sharecrop the fields of others. Their contract usually requires a return of a large portion of the crop to the landowner. Harvesting the crop successfully so that they can meet this debt and have enough left over for household maintenance requires intensive and timely male labour inputs. These families are living at subsistence level and the extra cost of hiring non-family labourers may be more than they can bear. The family labour requirements of the landless are constant, just to ensure survival, and represent the only hope of creating a surplus to better the position of the family.

Children represent a significant source of labour to families. Class and sex interact to influence their labour opportunities. Children become economically active before the age of 6 [Cain, 1977:213]. The larger the landholdings, the greater and earlier the production opportunities are for male children. However, since the relative inputs of all members of a household are

constrained by class position, sons in all families soon become significant economic actors compared with adults, and Cain estimates that sons are net producers by the age of 12. By the age of 15 their cumulative production will have exceeded their cumulative consumption. As sons usually remain in the household at least until their early twenties, and often much longer, they represent a significant economic contribution to the patriarchal household. Even after establishing a separate household, sons retain some economic responsibility for their elderly parents and usually represent the sole source of economic support for widowed mothers [Cain, 1977:223].

On the other hand, daughters do not compensate for the costs incurred during childhood before they marry and leave the paternal home [Cain, 1977:224]. The income earning opportunities of daughters are severely limited by the practice of purdah and the economic standing of the family. Ironically, the working hours of women appear to increase with size of landholding relative both to the men of that class and to landless women [Cain, 1979:417; Caldwell, 1982:357]. In addition to time-consuming household chores such as water and wood gathering, cooking and cleaning, and total responsibility for child care, they must attend to the processing of the crops. This work can be performed within the confines of the homestead, in keeping with purdah norms.

As most families in the functionally landless and landless classes do not produce large amounts of crops, females in these families have fewer work opportunities within the homestead. Poverty has forced many of them to break purdah norms and seek other

employment. Most acceptable is domestic service in the home of a relative or neighbour. Young girls will accompany their mother in this work, or babysit to enable the mother to go out to work. These jobs are often highly exploitative [Chen, 1983:59].

Agricultural processing jobs, another "acceptable" source of work for women, are disappearing in the wake of semi-mechanization. Husking mills, owned by the rich landowners, have greatly reduced the number of processing jobs available. Textile factories are taking away opportunities of home-based hand-loom production, the highest employment opportunity for women outside of agriculture [Chen, M. 1983:72; Westergaard, 1983:28].

Extreme poverty necessitates a more complete break with purdah norms. Many impoverished women and their older daughters seek work in the fields [Westergaard, 1983; Greely, 1983; Chen, M. 1983]. Due to competition with men and the dishonour of their position they are completely vulnerable to exploitation.

I've started working in the fields too. One morning I weeded onions on Talep's land, and he gave me two taka (5 cents). If he had hired a man, he would have had to pay more" [statement by a rural woman, quoted in Hartmann and Boyce, 1983:173].

Although many females of the poorest families are directly engaged in economic activity their earning power is markedly less than that of males. A detailed time use study [Table 3.1] conducted in two rural villages found that in families with female earning members, women earn half as much as men, and girls earn less than half that of boys [Begum and Greely, 1983:7].

TABLE 3.1

AVERAGE DISTRIBUTION OF HOUSEHOLD EARNINGS(1) BY FAMILY MEMBERS
IN TWO RURAL DISTRICTS (2), BANGLADESH, CIRCA 1983.

	FEMALE EARNING HOUSEHOLDS	NON-FEMALE EARNING HOUSEHOLDS
Ave. HH earnings (in taka)	2959	2880
Average Male earnings	1665	1925
Average % incomes:		
adult males	48.59	82.08
adult females	24.53	.84
all children	26.87	17.07
male children	18.25	15.28
female children	8.62	1.79

(1) these are all non-crop earnings; the average values of crop earnings per house hold were Taka 170 (FE) and Taka 385 (NFE).

(2) Comilla and Modhupur

SOURCE: Begum S and Martin Greely, "Women's Employment and Agriculture: Extracts From a Case Study", Women in Bangladesh: Some Socio-Economic Issues, 1983.

There is direct material advantage to the well-off when women are forced by extreme poverty to "work outside the system".

The culturally supported exclusion of women from the main source of wage work, that is, paddy operations, has the practical and, to cultivators, highly beneficial consequence of creating a pool of very inexpensive labor for use in more labour-intensive and less profitable crops such as potatoes and chilis" (Cain, 1977:208)

The ideology of purdah restricts women's economic opportunities and legitimizes their exploitation. Purdah then becomes an instrument of control and of capital accumulation, not in

this case by the family patriarch, but by the upper class. This is so because the village rich control not only the labour opportunities of poor women, but also the definition of the rules which prohibit them from seeking work outside this system. "The limits of purdah shift and change" [Chen, M. 1983:73] and are differentially applied to women of different classes. This is possible as the "Mulahs", the local religious leaders, are elected and to some extent controlled by the richest patriarchs. Thus, a trip to the city by the women of the higher classes will be seen as falling within purdah, while labour activities outside of the village boundaries by the poorest women will provoke social sanction and loss of status with potential negative consequences for both future work and marriage opportunities.

It is the strategy of the village leaders to keep us working at low wages in their homes. If we work outside, without purdah, then the rich people will not be able to advance credit to us poor women at exorbitant rates of interest. If we women work outside, we might be economically better off. [a poor rural Bangladeshi woman, quoted by M. Chen, 1983:59]

3.3 FEMALE CHILDHOOD MORTALITY: A STRATEGY FOR FAMILY WELFARE

It should be clear at this point that all classes, except perhaps the tiny minority at the top, would benefit economically by maximizing the timely production of their own male labour and minimizing the relative liability of female children. The cost of daughters does not only lie in their lack of economic opportunities. Early patrilocal marriage and the practice of dowry further reduces

the value of raising female children. In fact, dowry appears to have arisen because of the combination of growing poverty and devaluation of females, and has further contributed to both. The widespread practice of dowry is relatively new to Bangladesh. Within the last twenty or thirty years it has almost totally supplanted the traditional practice of brideprice, a payment made by the groom to the family of the bride in acknowledgement of her value. Dowry, the negotiated payment of money or possessions to the groom by the bride's family, was adopted by Hindus in the late 19th century for essentially economic reasons. It appears to have been adopted by the Muslims, who comprise almost 90% of the Bangladeshi population, for much the same reasons. [Lindenbaum, 1983: 394] Certainly, the change in practice has coincided with significant changes in rural life. Increased contact with the western world has fostered a move from agrarian subsistence to a cash economy. This shift appears to be accompanied by a change in prestige system from one based on land and aristocratic values with a strong network of kin obligation, to one based on individual values and the accumulation of money. It is males who have access to the new cash opportunities as purdah norms still greatly restrict the activities of women. Concurrent with this important change has been the trend to polarization of land ownership and increasing poverty. The sons of wealthy rural families were the first to secure contractual employment in the cities and towns and the wealthy families were the first to adopt the practice of purdah. As wage labour supplants agrarian self-sufficiency, more

and more males of the poorer classes have left the rural area for employment either in the larger centres or in the oil fields of Arab countries abroad.

According to Lindenbaum [1981] many people in a northern Bangladeshi village suggested that the practice of dowry "resulted from a numerical surplus of young women in the 1960's who remained in their fathers' homes" [Lindenbaum, 1981:394]. Although Lindenbaum discounts the demographic accuracy of this perception, it may not be inaccurate. In Matlab 1982 figures indicate that there were more than twice as many females in the 15-19 year age group as males in the 25-29 year age group [ICDDR,B., 1982:6]. Considering the customary age difference at marriage, rapid population growth and male migration to urban centres may indeed cause a shortage of the most "marriagable" men. In addition to supply and demand factors (perceived or real), dowry may be an acknowledgement that with decreased landholdings women are lesser contributors to the family welfare.

In any event, the practice of dowry also appears to foster poverty. One study found that the raising of dowry to marry off daughters accounted for the majority of land sales within a village [Islam, 1984]. Those without land incur further debt at the marriage of each daughter. This represents a real threat to family integrity and further contributes to the devaluation of female children.

To restate the argument, increasing polarization of wealth resulting in acute shortages of resources for an ever increasing number of families, and culturally determined restrictions on the value of females interact to create a situation where families of all but the highest class must act early in the life-cycle to maximize their male labour and minimize the costs of female children. Since 1974-79, the years spanned by Koenig and D'Sousa's study, the economic situation in Bangladesh has declined even further.

Estimates of the extent of increasing landlessness vary in exact number but not direction of change. According to Westergaard [1983:18] only five percent of the rural population were considered poor in 1963, whereas in the 1970's the proportion had risen to over 40%. This trend can be connected directly to decreasing land ownership. Within the same period, the average farm size decreased from approximately 3.5 to 2.8 acres. She also reports estimates of 38% absolute landlessness, or 48% "functional landlessness" in 1974. The situation in the Matlab area in 1982 has not improved, with 47% of households owning .4 acres or less. If we accept Cain's estimate of .65 hectares (or 1.6 acres) as the minimum amount of land necessary to support an average size family, [Cain, 1977:202], 80% of households associated with members of the 1982 birth cohort did not own viable acreage.

Table 3.2

OWNERSHIP OF LAND OF FAMILIES OF CHILDREN
BORN BETWEEN JULY AND DECEMBER, 1982, MATLAB

AMT. LAND OWNED	NO.OF HH.	% OF HH.	% OF LAND AVAILABLE
0 ACRES	998	25.4	0
.1 - .4 ACRES	860	22.0	5.1
.5 - 1.6 ACRES	1285	32.7	29.1
1.7 - 2.7 ACRES	388	10.0	19.8
2.8 - 29 ACRES	387	10.0	46.0

Put another way, in 1982 25% of households owned no land, 52% of households owned almost 95% of the land, and the top 10% of households owned 46% of the land. Even the amount of land owned by members of the top 10% was highly skewed, ranging from 2.8 acres to 29 acres.

Since the mid seventies, the local population has grown and male employment opportunities have diminished. The income-earning opportunities for females have declined significantly (Westergaard, 1983:30) and dowry has become an almost universal practice. In addition, mass poverty has further eroded kin-based support networks which have not been replaced by formal support systems.

If the overall thesis that families do make strategic decisions regarding the sex and sex ordering of their children is correct, one would expect that the growing landlessness and insecurity experienced in the eight intervening years between Koenig and D'Souza's study and this one would be reflected in a changed pattern of sex-differentiated childhood mortality.

3.4 HYPOTHESES

Several testable hypotheses arise from the above discussion and past studies. First, it is hypothesized that female cumulative mortality will overtake male mortality before the age of 8 months. The eighth month is chosen for several reasons. As males appear to have an inherently higher risk of death in the first few months of life, a higher proportion of females dying before eight months is indicative of deliberate and purposive behaviour on the part of parents to influence the differential rates. In addition, higher female deaths before eight months cannot be accounted for by generalized differential weaning and feeding practices, again suggestive of a deliberate and directed process. Finally, the timing of this excess female death would be at least seven months earlier than found by Koenig and D'Souza (1987) for the same area. It is doubtful that such a difference could be accounted for by yearly fluctuations, and would suggest that since 1974 there have been increased pressures influencing the risk of death for female infants.

Second, we are interested in establishing birth order as a basis for selectivity in female mortality within the first 4 1/2 years of life, regardless of socio-economic status of the family. As first births, young maternal age, and births to a family with a history of infant death, are all high risk categories (Phillips and Mozumder, 1984:11), it would be reasonable to expect that children with same sex siblings alive in the household at the

time of birth will experience lower mortality than those without same-sex siblings. However, consistent with the argument developed above that families gain an advantage by maximizing the number of male members and minimizing or limiting the number of female members it is hypothesized that the decrease in mortality afforded by the presence of one or more same-sex siblings will be much greater for males than females. A stringent test of difference would be that female mortality actually increases with the presence of female siblings.

Finally, it is hypothesized that birth order accounts for the anticipated excess mortality of females in the pre-weaning months. That is, in the presence of older same-sex siblings, females will have a higher mortality rate than males in the first eight months of life, while in the absence of older same-sex siblings, the more usual demographic phenomenon of higher male mortality will pertain. Such a finding would provide strong support for the argument that excess female mortality in the first months of life results from behaviours which are selectively applied to limit the number of female children relative to male children.

CHAPTER 4. DATA ANALYSIS

The data used in this study were collected by the International Centre for Diarrheal Disease Research, Bangladesh (ICDDR,B) an international non-profit centre for research, education, training and clinical service. In order to monitor demographic and other events such as the efficacy of certain medical interventions, a demographic surveillance system was created, providing coverage for a population of approximately 190,000. Community health workers visit each household regularly to obtain updates on demographic events. Socio-economic data pertaining to each household were obtained in a 1982 census. Data collection and analysis has been on-going for many years, resulting in a rich, longitudinal data set.

These data are particularly suited for analysis of sex differentials in mortality. As they are longitudinal a birth cohort can be followed, a great improvement to cross-sectional data. They are also an improvement over historical data (used by Das Gupta) as there is evidence that mothers may fail to report deceased children, especially if they are female [Arriaga, 1980; Cleland, 1988].

A sub-set of ICDDR,B's data has been obtained for this study containing demographic information spanning approximately 4 1/2 years for each child born in the surveillance area between July 1982 and December 1982, and socio-economic information on the household of each cohort child, obtained from a 1982 census.

TABLE 4.1

SELECTED DEMOGRAPHIC CHARACTERISTICS OF
BIRTH COHORT BORN JULY-DECEMBER, 1982,
MATLAB, BANGLADESH

N = 4377	male	female
a)births (net of out-migrants)	2046	1896
b)outmigrants	208	227
c)deaths (up to 60 months)	367	444
d) c) as % of a)	17.93%	23.36%
e)death rate < 1 year/1000 births	118	123

Between July and December, 1982, there were 4377 births in the Matlab study area. During the 4 1/2 years this birth cohort was followed 435 children were lost to the surveillance system due to out-migration.

In the study period there were 811 cohort deaths recorded. Of the males 367 died, or 17.94%. Of the females 444 died, or 23.42%. Thus, 1679 males and 1452 females were still alive after approximately 56 months.

TABLE 4.2

**INFANT AND CHILD MORTALITY RATES (DEATHS PER 1000 LIVE BIRTHS)
BY AGE AT DEATH AND BY SEX, 1974-77 MATLAB, 1982 MATLAB**

	AGE AT DEATH (in months)					
	< 1	1-11	0-11	12-23	24-54	0-54
1974-77 *						
males	78.2	52.6	130.9			
females	67.6	63.9	131.5			
total	73.0	58.2	131.2			
female/male	.86	1.21	1.00			
1982						
males	71.	47.	118.0	27.0	34.0	179
females	72.0	51.0	123.0	36.0	75.0	234
total	71	49	120	32	54	206
female/male	1.01	1.09	1.04	1.33	2.21	1.31

* source: D'Souza and Chen, 1980.

Table 4.2 shows that the female to male mortality ratio for the 1982 cohort is greater than 1 for every age interval of the study. This is especially noteworthy regarding the neonates (< 1 month). Whereas in 1974-77 the ratio reflected a strong advantage for females, it reflects a slight advantage for males in the 1982 cohort. A comparison of the cumulative proportion of children dying throughout early childhood by sex for three cohorts born 1966-73, 1973-74, and 1982 (Table 4.3) better illustrates this trend.

CUMULATIVE LIFE-TABLE PROBABILITIES
OF INFANT AND CHILD MORTALITY BY SEX FOR COHORTS
TABLE 4.3 BORN JULY-DECEMBER 1962, 1973-74, AND 1966-73; NATLAB, BANGLADESH

MONTHS	1962 COHORT			1973-74 COHORT *			1966-73 COHORT *		
	MALES	FEMALES	F/M	MALES	FEMALES	F/M	MALES	FEMALES	F/M
1	.071	.072	1.01	.067	.055	.82	.058	.046	.79
3	.032	.033	1.01	.034	.084	.83	.083	.071	.86
6	.104	.105	1.01	.106	.039	.92	.095	.085	.89
9	.108	.116	1.07	.114	.105	.93	.102	.034	.92
12	.118	.123	1.04	.121	.118	.98	.110	.102	.93
18	.134	.142	1.05	.136	.144	1.04	.120	.121	1.01
24	.154	.177	1.15	.152	.167	1.10	.132	.141	1.07
30	.164	.197	1.20	.165	.189	1.14	.141	.160	1.13
35	.170	.214	1.26	.175	.203	1.16	.147	.175	1.19
42	.176	.227	1.29	.180	.210	1.17	.151	.181	1.20
48	.179	.232	1.30	.185	.220	1.19	.152	.186	1.22
54	.179	.234	1.31	.190	.228	1.20	.156	.188	1.19
(N)	(2046)	(1836)		(5811)	(5643)		(4231)	(4322)	

* Source: Pionig and D'Souza, 1986

The salient information in the above table is the age at which proportionally more females than males died for each cohort. Whereas female cumulative mortality did not overtake that for males until approximately 18 months for the earliest cohort, and 15 months for the middle cohort, for the 1982 cohort there was no crossover in the data *. Female cumulative mortality rates were higher than those for males from the first month until the end of the study period (Figure 4.1).

The data for the 1982 cohort appear to document a change in possible mechanisms for sex-differentiated mortality. Neither sex-selective ravages of disease nor differential weaning can account for this shift. We must consider then the stark reality of active discriminatory behaviour on the part of the family immediately following birth.

* The definition used for first month followed the conventional 0-29 days. As there were 6 male and 1 female deaths on day 30, the sex-differential is extremely weak in the neonatal period.

FIGURE 4.1

Now that the likelihood of active discrimination against daughters shortly after birth has been established, the next task is the identification of characteristics, either of the families or of the daughters themselves, which are associated with increased risk of death. Table 4.4 contains a breakdown of mortality by sex and by selected socio-economic characteristics of the household. For all categories and their sub-divisions it should be noted that the female/male mortality ratio is greater than 1 with the sole exception of those with mothers aged less than 20. (This exception is probably a result of a combination of the extreme high risk of peri-natal complications to children of immature mothers and a likelihood that they are first births).

Education refers to the highest level achieved within the household. The female/male mortality ratio for this group is smaller than that for other groups but still pronounced. Interestingly education of 1-6 years appears to disadvantage rather than advantage daughters. The ratio for this group is 1.35 compared to 1.29 for those whose households have no education.

Religious affiliation appears to influence the ratio. Moslems, 88% of the total population, have a F/M mortality ratio of 1.27, whereas the ratio for Hindus (accounting for almost all of the remaining 12% of the population) is 1.41.

The landholding status of the family is of particular relevance to the thesis of this paper. It was hypothesized that increased polarization of this basic resource would cause increased

TABLE 4.4

DEATH RATE (PER 1000 LIVE BIRTHS, July-Dec. 1982) FOR AGES 0-54 MONTHS BY SELECTED SOCIO-ECONOMIC CHARACTERISTICS OF HOUSEHOLD AND BY SEX (excluding out-migrants during study period)

SELECTED HH CHARACTERISTICS	MALES	FEMALES	F/M
OVERALL	179	234	1.31
MOTHER'S AGE			
<20	249	231	.93
20-29.9	162	234	1.44
30 +	162	236	1.46
EDUCATION *			
none	193	249	1.29
1-6 years	170	229	1.35
7-16 years	(145)	(175)	(1.21)
RELIGION			
Moslem	179	228	1.27
Hindu	182	256	1.41
LAND **			
Landless	207	256	1.24
< .5 acres	169	257	1.52
.5- 1.3 acres	170	227	1.34
1.4 -29 acres	171	192	1.12
SIBLINGS			
without older			
same sex sibs	211	224	1.19
with older			
same sex sibs	156	243	1.56

Note: figures in parentheses based on less than 40 deaths

* Education refers to highest attained by any household member

** Less than .5 acres is considered "functionally landless" (Westergaard, 1983, p.18)

Each group represents a quartile of the frequency distribution of land which is highly skewed.

pressure on families to develop strategies of competition. One possible strategy is the timing and sex composition of children. It was also argued that although the highest class might be less dependent on such a strategy, the landless, functionally landless, and middle classes would all, albeit for different reasons, resort to such family-building strategies. Evidence in the above table supports this hypothesis. The highest female to male ratio is found in the functionally landless class, those families who are either caught in a downward mobility spiral (probably the majority) and those who are rising and attempting to consolidate land security. Either way, there is not sufficient land to require a great deal of female labour, and daughters threaten land security through dowry.

Finally, the presence of older, same-sex siblings was considered without controlling for other variables. There is a dramatic difference in the ratio from 1.19 to 1.56 for those children who had one or more siblings of the same sex at the time of birth. It therefore appears worthwhile to further examine the issue of birth order.

TABLE 4.5

CHILD MORTALITY BY BIRTH ORDER BY SEX
 BASED ON DEATHS BETWEEN 0-54 MONTHS PER 1000 LIVE BIRTHS
 FROM JULY-DECEMBER, 1982, MATLAB (excluding out-migrants)

SEX OF CHILD	BIRTH ORDER (not disaggregated by sex)			
	1	2	3	4+
MALE	256	146	160	154
FEMALE	244	246	230	223
TOTAL	250	193	191	188
FEMALE/MALE	.95	1.68	1.44	1.45

FIGURE 4.2

MORTALITY RATE BY BIRTH ORDER BY SEX

TABLE 4.6

CHILD MORTALITY RATES BASED ON COHORT BORN JULY-DECEMBER, 1982, MATLAB
(deaths at age 0-54 months per 1,000 live births) by SEX, SIBLING STATUS
and SELECTED CHARACTERISTICS OF HOUSEHOLD.

Birth Cohort	SAME SEX SIBLINGS						OPPOSITE SEX SIBLINGS					
	MALE			FEMALE			MALE			FEMALE		
Siblings alive at birth of cohort child	(a)	(b)	(% diff)	(c)	(d)	(% diff)	(e)	(f)	(% diff)	(g)	(h)	(% diff)
	0 bro	1+ bro		0 sis	1+ sis		0 sis	1+ sis		0 bro	1+ bro	
OVERALL	211	156	-26	224	243	+08	226	144	-36	252	222	-12
MOTHER'S AGE												
Less than 20	265	(116)	-56	231	(234)	+01	271	(68)	-75	246	(125)	-45
20 to 29.99	172	155	-10	214	249	+16	185	147	-21	252	224	-11
30 and over	(178)	160	-35	(239)	236	-01	(256)	147	-43	(279)	230	-18
LAND OWNERSHIP												
LAND *	201	149	-26	201	220	+09	200	147	-27	222	205	-08
0 LAND	230	188	-18	246	266	+08	265	168	-37	302	222	-26
Functionally Landless **	211	137	-35	245	266	+09	250	108	-57	253	259	+02
BOAT OWNERSHIP												
1+ BOATS	211	152	-28	219	227	+04	215	149	-31	254	202	-20
0 BOATS	212	160	-25	226	257	+14	239	139	-42	245	243	-01
HIGHEST EDUCATION LEVEL IN HOUSEHOLD												
7-16 SECULAR YEARS	(219)	(100)	-54	(180)	(171)	-05	(214)	(98)	-54	(167)	(179)	+07
1-6 SECULAR YEARS	187	158	-16	230	229	+00	211	139	-66	262	206	-21
0 SECULAR YEARS	224	167	-25	226	267	+18	240	156	-35	258	241	-07
RELIGION OF H.H.												
MUSLIM	207	159	-23	223	233	+04	219	150	-32	243	219	-10
HINDU	232	138	-36	216	230	+34	270	109	-60	278	234	-16

-all rates in parentheses are based on fewer than 40 deaths

* Owning .5-29 acres.

** Owning .1-.4 acres.

- "% Diff" = ((a-b)/a * 100)

note: 0 bro(sis) refers to cases with no living brother (sister)
in household at time of birth of cohort child and
1+ bro(sis) refers to cases with at least one living
brother (sister) in household at time of birth of cohort
child. These categories are not all mutually exclusive.

Table 4.6 above contains a great deal of information about the effects of the absence or presence of older brothers and older sisters on the mortality of daughters and sons in the 1982 birth cohort.

First we will consider the left hand side of the table: the mortality experience of the cohort with or without same-sex siblings at their birth. Before considering the breakdown by family characteristics, let us examine the overall rates (row 1). First, note that males with older brothers have a 26% lower mortality rate than those without older brothers. Some of this difference is accounted for by the high risk of first birth. In addition, siblings who died before the birth of the cohort child are not included in this data. As mentioned earlier, a history of childhood death in a family is a good predictor of neo-natal mortality [Phillips and Mozumder, 1984]. However, females with older sisters have an 8% greater mortality than those without sisters. Note also that the rates for females, with or without female siblings, are higher than the rates for males, with or without male siblings.

For the most part, these relationships are found for every sub-category of household characteristics examined in the rest of the left hand side of the table. Of particular interest are the sex differentials by birth order when controlling for land ownership. In all classes of land ownership, the males enjoy a considerable reduction in mortality if there are one or more older brothers in the household at birth but females consistently have an

approximately 9% increase in mortality if they have older sisters.

There are few exceptions to the patterns noted above. The presence of brothers is always accompanied by a decrease in mortality for the males. The presence of sisters is accompanied by a decrease in mortality for females only in the cases of a) mothers aged over 30, and b) educational level of household over 7 years. However, the rates in both of these categories are based on very small numbers of deaths, and in neither case is the mortality reduction anything like the magnitude of the reduction for males with older brothers. It therefore seems fair to conclude that the presence of older brothers offers some protection against mortality for males, while the presence of older sisters increases the risk of mortality for females.

We now turn to the right-hand side of the table: mortality experience of males and females with opposite sex siblings. The reduction in mortality for males with older sisters compared with males without older sisters is consistent and always larger than the reduction due to the presence of brothers. The pattern is less consistent for females but, by and large, their mortality decreases in the presence of older brothers, and one can say that having older brothers appears to afford them some protection. Therefore, the presence of opposite sex siblings consistently "protects" males and usually "protects" females.

We can conclude that birth order does affect the sex differentials of childhood mortality regardless of socio-economic status. Older siblings of either sex afford better life chances to males. Female life chances are improved in the presence of older brothers but decreased in the presence of older sisters. These findings again support the thesis of active discrimination against females, especially higher order females, as part of a familial competitive strategy for community resources whose distribution is highly inequitable.

The obvious question arising from the above analyses concerns the connection between same sex birth order and the relationship between male and female cumulative proportional mortality. If we control for same sex birth order, we can hypothesize that female cumulative mortality will be higher throughout the study period than male cumulative mortality for those with same sex siblings in the household at birth. That is, there would be no crossover. On the other hand, it is expected that there is little strategic reason for families to discriminate at early ages against females who do not have older sisters. Therefore, in the absence of older same sex siblings, males should show the more usual higher cumulative rates during infancy, with female cumulative mortality overtaking only in the second year.

TABLE 4.7

CUMULATIVE PROPORTION OF INFANTS AND CHILDREN
DYING BETWEEN 0-54 MONTHS BY PRESENCE OF SAME-SEX
SIBLINGS AND BY SEX
(for cohort born July-December, 1982, Matlab)

WITH SAME-SEX SIBLINGS				WITHOUT SAME-SEX SIBLINGS		
MONTHS	FEMALES	MALES	F/M	FEMALES	MALES	F/M
1	.059	.050	1.18	.087	.098	.89
3	.076	.065	1.17	.114	.129	.88
6	.091	.079	1.15	.123	.137	.90
9	.101	.081	1.25	.133	.143	.93
12	.108	.091	1.18	.142	.155	.92
18	.126	.106	1.19	.162	.171	.95
24	.165	.129	1.28	.191	.188	1.02
30	.191	.139	1.37	.204	.203	1.00
36	.215	.144	1.49	.213	.205	1.04
42	.233	.151	1.54	.220	.211	1.04
48	.239	.156	1.53	.222	.211	1.05
54	.243	.156	1.56	.224	.211	1.06
(N)	1037	1169		859	877	

FIGURE 4.3

Cumulative proportion of children dying, with same sex siblings in household at birth, by sex; cohort born July-Dec. 1982 Matlab, Bangladesh. ▲ female ■ male

Cumulative proportion of children dying, without same sex siblings in household at birth, by sex; cohort born July-Dec. 1982, Matlab, Bangladesh. ▲ female ■ male

The cumulative proportion of males and females dying, with and without same-sex siblings in the household at time of birth, are presented in Table 4.7 and illustrated in Figure 4.3. As expected, there is no crossover of male and female rates when same-sex siblings are present in the household. The cumulative proportion of females dying is higher than that for males throughout the study period. Again, as expected, for children without same-sex siblings in the household at the time of birth, male cumulative mortality is higher than that for females until approximately 24 months of age. A crossover occurs sometime between 18 and 24 months such that females have a higher proportion deaths from then until the end of the study period.

The timing of crossovers of cumulative rates are highly influenced by levels in the earliest months. This does not present a problem in the analysis of the group with same-sex siblings as there is no cross-over. However, a breakdown of mortality rates by month and sex and their respective ratios is necessary to establish the nature of the relative mortality pertaining to the group without same-sex siblings. As monthly rates tend to be quite small after the early infancy period, moving averages are employed to smooth the data [Table 4.8].

As expected, the interval rates for females with sisters are higher than those for males with brothers in all "pre-weaning" intervals (less than 8 months), and most significantly, in the "neo-natal" interval. In contrast, the early mortality

Table 4.8

DEATHS (PER 1000 STILL AT RISK) BY AGE IN MONTHS, SEX, AND
 PRESENCE OR ABSENCE OF OLDER SAME-SEX SIBLINGS
 (averaged over 3 month intervals), cohort born July-Dec. 1982,
 Matlab, Bangladesh

3 month intervals	With-out same-sex siblings			With same-sex siblings		
	Males	Females	f/m	Males	Females	f/m
1-3	44.3	38	.86	21.7	25.7	1.18
2-4	11.3	9.7	.86	6.0	8.0	1.33
3-5	5.7	5.0	.88	4.3	5.0	1.16
4-6	3.0	3.3	1.10	4.3	5.0	1.16
5-7	2.3	2.7	1.17	2.7	4.7	1.74
6-8	1.0	2.7	2.70	1.7	4.7	2.76
7-9	1.7	3.0	1.76	1.0	3.7	3.70
8-10	1.7	2.3	1.35	2.3	3.0	1.30
9-11	3.7	3.3	.89	3.0	2.3	.77
10-12	3.7	3.7	1.00	3.3	2.0	.61
11-13	3.3	3.3	1.00	2.0	3.0	1.50
12-14	1.0	3.7	3.70	2.7	2.0	.74
13-15	2.0	4.0	2.00	2.7	2.3	.85
14-16	4.0	4.0	1.00	3.3	3.0	.91
15-17	5.7	3.7	.65	3.0	3.7	1.23
16-18	4.0	3.3	.85	3.0	4.7	1.57
17-19	3.3	3.3	1.00	3.7	4.3	1.16
18-20	3.3	5.0	1.52	4.7	6.7	1.43

rates of males are much higher than those for females when there is no older same-sex sibling. However, female mortality for this group overtakes male mortality somewhere between 4 and 6 months and remains higher until the 9-11 month interval. This range of intervals begins before weaning could explain the sex-differential but overlaps the time of weaning. Thus, the comparative risk of death in the pre-weaning months for the two groups is not as distinct as expected.

On the other hand, the surprisingly high pre-weaning mortality of females without older sisters may be an indication that even this group is increasingly at risk as families seek to increase their chances of survival and success in an atmosphere of intense competition for scarce resources.

A breakdown of early monthly mortality experience by land-holding status indicates that for all classes except the highest who own more than 1.6 acres of land, female mortality for those with same-sex siblings exceeded male mortality in each of the first 6 months. The highest ratio was found in the class which owned .1 to .4 acres. The ratio was 1.6 for the first month of life, and 1.43 for the first 6 months of life.

CHAPTER 5. DISCUSSION AND IMPLICATIONS

The argument developed throughout this paper is that deteriorating socio-economic conditions compel families to develop strategies of survival. Families with relatively high economic means must ensure that they retain their advantage, while impoverished families must find ways to ensure survival. Those in the middle are subject to a general downward pressure and must also compete to maintain their position. As social and economic institutions are patriarchal in nature, one immediate strategic device available to families is to maximize their male labour and minimize the cost of daughters. Sex-selection by amniocentesis has recently become available and popular in more affluent areas of South Asia, but is not available to the rural villagers of Bangladesh. Thus, while families cannot determine the sex of a child at birth, they can selectively influence their chances of survival.

Data on the mortality experience of a 1982 birth cohort from Matlab, Bangladesh, provided the opportunity to test this thesis. Cumulative mortality rates by sex were compared to earlier findings for the same geographical area and suggest a trend to extremely early excess female mortality. Further cohort studies are needed to confirm the existence of this trend.

Females born in Matlab in 1982 experience higher mortality than males in the neonatal and infant months, thus precluding differential weaning as a possible causal mechanism. In addition, this very early mortality was accounted for by females who already

had at least one older sister in the household at the time of birth, for all landowning categories except the highest 20%, suggesting that early mortality is directed and deliberate. These findings lend strong support to the thesis that female childhood mortality provides a strategic mechanism for families.

The early mortality experience of these females did not correspond to an elimination of the higher risk of death for females older than 8 months and differential feeding practices remain a probable mechanism for this age group. This finding does not contradict the thesis of this paper, as families not only benefit from the early and plentiful production of male children, they must then ensure that these sons remain healthy and live to adulthood.

There are considerable implications in these findings. Only the changing economic conditions can account for the radically reduced age of higher female mortality in the eight years since Koenig and D'Souza's study. The economic institutions are patriarchal and, as they disintegrate in the face of crises, rapid population growth, and polarization of wealth, the very lives of female infants appear to be endangered.

Economic development alone is a doubtful solution. Das Gupta described the same mortality phenomenon in Punjab, India, an area which has recently experienced considerable economic growth and modernization due to the Green Revolution. As Bangladesh enters the modern global economy, and a cash-based economy replaces family agrarian self-sufficiency, the new social and economic institutions must also contain mechanisms whereby females have access to

productive activities and control over their earnings and property. The problem of polarization of wealth must also be addressed through land reform, as intense competition for resources appears to heighten the exploitation of women and the strategic value to families of limiting their numbers.

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APPENDIX A

The calculation of monthly mortality rates requires a reliable estimate of the population actually at risk of dying in any particular time period under consideration. In terms of measurement, reporting, and coding error, demographic data from Matlab has a reputation of being highly reliable and is used as a benchmark for sample surveys conducted in Bangladesh [Preston, 1985:255]. However, the effects of out-migration have not been fully considered. This thesis employs the usual technique of removing any cases of out-migration throughout the duration of the study. The underlying assumption is that the mortality experience of these out-migrants is the same as that for the remaining members of the cohort. As there is no direct, measured, evidence of similarity, and because the ratios, so important to the thesis of this paper, are sensitive to small adjustments in the sex-specific rates, an attempt is made in this appendix to take into account the effect of out-migration. Instead of ignoring out-migration, the mid-interval population at risk is here defined as population at the beginning of the interval plus $1/2$ (deaths + outmigrants). [Table 6.1]

TABLE 6.1

AGE-SEX-SPECIFIC DEATH RATES, MATLAB, 1982-86

AGE INTERVAL (months)	POPULATION AT BEGINNING	OUT- MIGRATION	DEATHS	POPULATION AT RISK*	DEATH RATE	
MALES					M	F
0-1	2254	8	145	2177.5	66.6	66.3
1-3	2101	13	44	2072.5	21.2	21.0
3-6	2044	18	23	2023.5	11.4	12.1
6-9	2003	15	8	1991.5	4.0	10.2
9-12	1980	10	22	1964.0	11.2	8.2
12-18	1948	20	32	1922.0	16.7	20.3
18-24	1896	40	42	1855.0	22.6	38.4
24-30	1814	23	20	1792.5	11.2	23.6
30-36	1771	11	12	1759.5	6.8	21.2
36-42	1748	24	13	1729.5	7.5	16.6
42-48	1711	22	6	1697.0	3.5	5.4
48-54	1683	4	-	1681.0	-	3.4
-	1679	208	367	1966.5	186.6	248.4
FEMALES						
0-1	2123	5	136	2052.5	66.3	
1-3	1982	11	41	1956.0	21.0	
3-6	1930	21	23	1908.0	12.1	
6-9	1886	23	19	1865.0	10.2	
9-12	1844	19	15	1827.0	8.2	
12-18	1810	30	36	1777.0	20.3	
18-24	1744	40	65	1691.5	38.4	
24-30	1639	20	38	1610.0	23.6	
30-36	1581	19	33	1555.0	21.2	
36-42	1529	15	25	1509.0	16.6	
42-48	1489	18	8	1476.0	5.4	
48-54	1463	6	5	1457.5	3.4	
-	1452	227	444	1787.5	248.4	

* Population at risk = $1/2(\text{population at beginning} + \text{population at end})$
= Population at beginning + $1/2(\text{deaths} + \text{outmigrants})$

The adjusted figures allow us to retain confidence in sex-based comparisons employed throughout the thesis. According to the adjusted figures, although male mortality in each of the first two intervals is slightly higher than that of females, females lose even this slight advantage by the 3-6 month interval.

END

19|09|90

FIN