Does Child Mortality Reflect Gender Bias? Evidence from Pakistan

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Abstract

In this paper we use child level data from Pakistan to estimate the probability of child mortality. We find that overall girls have a higher probability of surviving and when we look at disaggregated data we find that relative to boys, girls have a significantly lower probability of dying in the age group 0 - 1 but have a significantly higher probability of dying in the age group 1 - 5. The results are robust to mother level unobserved heterogeneity. Education of the mother is seen to have a significant and negative effect on child mortality and there is a threshold level of education that the mother has to attain before education starts affecting child mortality. We also find that increased duration between the births significantly reduces child mortality. We argue that the higher mortality of girls in the age group 1 – 5 reflects discrimination against girls in the form of lower health and other resource inputs.

Key Words: Child Mortality, Gender Bias, Pakistan

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1. Introduction

There now exists a fairly large literature, primarily using data from developing countries, that documents parental preferences for sons over daughters. This is known as the 'son preference hypothesis'. Observable evidence of son preference include female infanticide, longer duration following the birth of a son and lower health and educational inputs for girls. For example, Leung (1988) and Raut (1996) find evidence of preference for sons among the Chinese but not the Malays in Malaysia. Larsen, Chung and Dasgupta (1998) using data from Korea find that women who already have a son are less likely to have another child and if they do proceed to have another child they take longer to conceive the subsequent child. Khan and Sirageldin (1977) find that son preference affects the actual child bearing intentions of parents in Pakistan and Aly and Shields (1993) use data from Egypt to show that the probability of a woman using contraception increases with the number of existing sons. Gangadharan and Maitra (1999) find that in South Africa, Indian households exhibit significant preference for sons by delaying the conception of the subsequent child following the birth of a son. In South Asian countries one observes a significant proportion of girls neither attending school nor working in the daily wage labour market. It appears that girls remain at home helping with domestic work like cooking, cleaning and taking care of younger siblings.[1]

Does discrimination against girls reflect itself in higher child mortality among girls? As women have a natural biological advantage, when female child mortality is as high or higher than male child mortality, there is reason to believe that girls are often discriminated against. Further since an outcome like child mortality is unlikely to be the result of choices made by the particular child, a gender difference in child mortality therefore could be an indication of the differential treatment by the parents and/or other caregivers.

This paper uses individual level unit record data from Pakistan to examine the factors that affect the probability of child death. Pakistan is an interesting country to study. The existing evidence shows that there is a band across Northwestern India and Pakistan and this region is characterised by severe gender differentials in child mortality rates going as far back as 1872.[2] However there is very little work specifically on Pakistan and more over work using unit record data of the kind we use in this paper and using the level of disaggregation that is used in this paper is rarely seen. The only other paper that analyses child mortality in Pakistan is Kiani (1992) who uses the Pakistan Contraceptive Prevalence Survey Data to examine the demand for health care services and its effect on child mortality. To the best of our knowledge, ours is the first paper to use child level data on mortality and examine gender differentials in child mortality. In this paper the unit of analysis is the child, so characteristics of the child are included. We are able to incorporate information on each child - the sex of the child, the birth order of the child, the duration between children, all of which can potentially affect child mortality. If we conduct our analysis at the mother level we will not be able to incorporate any of these individual level characteristics. Apart from incorporating child characteristics in our analysis, we also control for the fact that several children may have the same mother and there might be certain mother level characteristics (common to all the children – mother level unobserved heterogeneity) that might affect child mortality.

We model the probability of a child dying using probit estimation. The probability of a child dying is assumed to be a function of the child characteristics (which would include the gender of the child), characteristics of the mother and father and other socioeconomic characteristics of the household. Our estimation results show that compared to a boy, a girl has a significantly lower

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[1] For example, Maitra and Ray (2000) show that in Pakistan the proportion of boys that attend school is significantly higher than the proportion of girls that attend school and the proportion of girls that neither attend school nor work in the labour market is significantly higher than the corresponding proportion of boys.

[2] See Miller (1982, 1993), Murthi et al (1995), and Filmer, King and Pritchett (1998).

probability of dying overall and in the age group 0 - 1. However girls have a significantly higher probability of dying in the age group 1 - 5. In addition we find that increased duration between children significantly reduces child mortality. Also highest education of the mother more than primary school reduces child mortality overall and in the age group 0 - 1.

The rest of the paper is organised as follows. Section 2 describes the data set used in our analysis and presents some selected descriptive statistics. Section 3 presents the estimation methodology and describes the explanatory variables that are used. Section 4 presents the results and Section 5 concludes.

2. Data and Descriptive Evidence

The data set that we use in this paper is from Pakistan Integrated Household Survey (PIHS) conducted in 1991. This survey was conducted jointly by the Federal Bureau of Statistics, the Government of Pakistan and the World Bank as a part of the Living Standard Measurement Study (LSMS) household surveys in a number of developing countries. These surveys provide policy makers and researchers with individual, household and community level data needed to analyse the impact of policy initiatives on living standards of households. The PIHS teams visited 4800 households residing in rural and urban communities. The nation-wide survey gathered individual and household level data using a multi-purpose questionnaire.

Every ever-married woman in the sample was asked about her maternity history. In particular every woman was asked about the sex of each child, when the child was born, whether the child is still alive at the time of the survey and if dead how long did the child live. We were able to obtain the maternity history for 4564 women from 3790 households. The average number of children for each woman is 4.80, the maximum number of children being 14 and the minimum being 1. Figure 1 presents the frequency distribution of the number of children per woman in the sample. Approximately 87% of the sample of women who have children have more than one child. Therefore it is important to take into account mother level heterogeneity in our estimation. In Pakistan conception prior to marriage is neither common nor socially acceptable. Therefore it is unlikely that we lose much information by ignoring women who have not been married. Also since the focus of our paper is on child mortality, we ignore the data on women who have never been pregnant. Our sample therefore consists of 21801 children ever born to the 4546 ever-married women in the sample of which 16.39% children are not alive at the time of the survey. Of the children that are not alive at the time of the survey, 2918 (75.62%) died before the age of 1, 714 (18.5%) died between the ages 1 and 5 and the rest (5.88%) died after reaching the age of 5. Of the 21801 children in our sample 10495 (48.14%) are girls and the rest are boys. Of the children who have died, 45.66% are girls. Table 1 presents selected descriptive statistics on both the mother level and the child level variables.

It has been argued that more educated women will experience lower child mortality rates. Education lowers the cost of information and it is likely that more educated women have a better understanding of the value of public health infrastructure and are better able to locate and utilize these services. A child whose mother is more educated is likely to benefit more from better access to health-care and toilet facilities relative to a child whose mother is less educated. Moreover there is evidence that suggests that female education may also affect the traditional balance of family relationships, which may benefit children. For example Hoddinott and Haddad (1994) and Thomas (1990) find that mother's income has a positive effect on child anthropometric measures. Doss (1997) finds that the completed level of child schooling is positively related to current assets owned by women and Quisumbing and Maluccio (2000) find that assets controlled by women have a positive and significant effect on expenditure allocations towards the next generation, such as education and children's clothing. Given that education and income are positively related it is quite likely that higher levels of maternal education will lead to lower child mortality. Caldwell (1979) argues that household preferences involving food types consumed and methods of childcare may vary with the level of education of the women. Mellington and Cameron (1999) using data from Indonesia find that educated women have a significantly lower probability of experiencing child death. Using census data from India, Bourne and Walker (1991) found that improved mother's education reduced mortality at all ages below five years for both sexes and the effect was found to be greater on girl than on boy children, particularly in the northern states of India. Descriptive evidence from Pakistan (Table 2) shows that mother's education significantly reduces child mortality. If we consider the sample of children that have died, 87.51% had mothers with no education. This proportion drops sharply to 8.66% if the mother can write and 10.86% if the mother can read. Similarly the figure drops to 6.06% if the mother has some primary education, 3.36% if the mother has more than primary education (but less than secondary education) and to 0.75% if the mother has more than secondary education. Notice that the effect of mother's education on child mortality is stronger for girls compared to boys - of the girls that have died 90.47% had mothers with no education and 0.34% had mothers with more than secondary schooling (the corresponding proportions for boys are 88.70% and 1.10% respectively).

3. Estimation Methodology and Explanatory Variables Used

We examine the probability that the child dies, the probability that the child dies in the age group 0 - 1 and the probability that the child dies in the age group 1 - 5. The probabilities of the child dying are estimated using a series of probit models. The probit model assumes that there is a latent variable y^*, which can be written as a linear function of the variables that affect the probability of each child dying. Hence we can write

$$y^* = \beta X + \varepsilon \quad (1)$$

where X is a vector of exogenous explanatory variables, β is the vector of coefficients and ε is a random error term. The latent variable (the probability that the child dies) is unobserved. Instead we observe the following dummy variable

$$y = \begin{cases} 1 \text{ if } y^* > 0 \\ 0 \text{ otherwise} \end{cases}$$

Note that here $y = MORTALITY, MORTALITY\_01, MORTALITY\_15$ where:

$$MORTALITY = \begin{cases} 1 \text{ if the child is dead at the time of the survey} \\ 0 \text{ otherwise} \end{cases}$$

$$MORTALITY\_01 = \begin{cases} 1 \text{ if the child died between the ages 0 and 1} \\ 0 \text{ otherwise} \end{cases}$$

$$MORTALITY\_15 = \begin{cases} 1 \text{ if the child died between the ages 1 and 5} \\ 0 \text{ otherwise} \end{cases}$$

Child death is assumed to depend on a set of chid, parent, other household and community characteristics. Hence the following equation is estimated.

$$y = \beta_0 + \beta_1 CHILD + \beta_2 PARENT + \beta_3 HOUSEHOLD + \beta_4 COMMUNITY + \varepsilon \quad (2)$$

We conduct two sets of estimations for each category. Some of the unobserved factors (reflected in the error term) consist of child level characteristics while others are similar across all children born of the same mother. All of these children might be affected by the common characteristics of the mother, biological and otherwise (for example, education level of the mother). It is therefore important to account for this in the estimation. The residual term of the probit index function (equation (1)) can be divided into two parts

$$y^* = \beta X + \eta + u \quad (3)$$

Here η is constant across all children born to the same mother (mother level unobserved heterogeneity) and u is any other unobserved heterogeneity. This $\eta \sim N(0, \sigma_\eta^2)$ and could be correlated with other heterogeneity terms and $u \sim IIDN(0,1)$. Our estimation results show that this unobserved mother level component is always significant. For more details on this econometric issue, see Panis and Lillard (1994). Fixed mother level characteristics (common to all children born of the same mother) can also be accounted for by including specific explanatory variables – for example the number of elder siblings that have died before this child was born can be regarded as a proxy for the biological endowment of the mother. See Gangadharan and Maitra (2000) for details. The approach in this paper is an improvement over our earlier work because this approach is more robust. It can account for all possible mother level unobserved characteristics and does not suffer from the omitted variable bias of our earlier approach and the estimates are consistent.

The probability of a child dying will depend on child characteristics, characteristics of the mother and father and the household's socio-economic status. Let us start with the characteristics of the child. They include a dummy for the sex of the child (*GIRL*), the time difference from the previous child (*DIFFPREV*), the time difference from the next child (*DIFFNEXT*) and the birth order of the child (*BIRORDR*). If the child mortality rates are indeed higher among girls, the coefficient of *GIRL* should be positive and significant. Lower duration between children is likely to have an adverse effect on child quality and is therefore expected to adversely affect child mortality (the resource constraint or the sibling competition effect) and therefore we expect both *DIFFPREV* and *DIFFNEXT* to be negative. The literature argues that the birth order of the child is likely to have a significant effect on child quality (including child mortality). Behrman (1988) and Birdsall (1991) argue that since parents' income increases over the life cycle, children born later in life are more likely to benefit because more resources are available to parents in the later stages of their life. This is likely to be reflected in higher child mortality rates for children born earlier (children of a higher birth order).[3] Birth order effects may also be due to biological characteristics - children of lower birth order are born to older mothers and because of the maternal depletion effect children born to older mothers are more likely to have lower birth weight and are more likely to die early. On the other hand it has also been argued that children born early (first-born children particularly) are also likely to have a lower birth weight. Similarly birth order effects can arise because of cultural factors. For example Horton (1988) argues that the eldest son is particularly important because they perform the funeral rites. Overall however we would expect to see that children of a lower birth order have a lower probability of dying - the sign of *BIRORDR* should be negative. Finally we also control for the age of the mother at the time of childbirth by including the following two variables: *AGEMBRTH* (the age of the mother at the time of childbirth) and *AGEMSQ* (the square of the age of the mother at the time of childbirth). The last term accounts for the possible non-linearity in the effect of the age of the mother at the time of childbirth on child mortality.[4]

Characteristics of the mother include the relationship of the mother to the head of the household, which is measured by two dummy variables, *RELHDM1* = 1 if the mother is the head of the household and *RELHDM2* = 1 if the mother is the spouse of the head of the household and three dummies for the highest level of education attained by the mother. The three dummies are *EDUCM1* = 1 if the highest education attained by the mother is primary schooling, *EDUCM2* = 1 if the highest education attained by the mother is more than primary schooling but not more than secondary schooling and *EDUCM3* = 1 if the highest education attained by the mother is more than secondary schooling. Some studies have however suggested that it is literacy rather than years of formal education that is important.[5] Literacy and the number of years of education are closely

[3] Note that we denote children born earlier as having a higher birth order and children born later as having a lower birth order.

[4] Note that *AGEMBRTH* and *AGEMSQ* are child level variables and not mother level variables because they are specific to each child.

[5] For example United Nations (1991) states that ``literacy is a better measure of education than enrollment since it usually reflects a minimal level of completed schooling".

related variables. The PIHS data set however allows us to use both as explanatory variables. We define the following two dummy variables *MOTHREAD* (which takes a value of one if the mother is able to read) and *MOTHWRIT* (which takes a value of one if the mother is able to write).

We control for the socio-economic status of the household by including variables reflecting the level of education of the father of the child.[6] We include three dummies to indicate the highest level of education of the father *EDUCF1* = 1 if the highest education attained by the father is primary schooling, *EDUCF2* = 1 if the highest education attained by the father is more than primary schooling but not more than secondary schooling and *EDUCF3* = 1 if the highest education attained by the father is more than secondary schooling. Additionally we include two dummy variables to measure whether the father is literate: *FATHREAD* (which takes a value of one if the father is able to read) and *FATHWRIT* (which takes a value of one if the father is able to write). We also include a dummy variable to indicate whether the father is the head of the household (*RELHDF1*). Other household level characteristics that we include are the log of per-adult equivalent total expenditure (*PCEXP1*), total number of children in the household (*TOTCHILD*) and the total number of adult males and females in the household (*TOTADTM* and *TOTADTF* respectively) and a dummy to indicate whether the household lives in a rural area (*RURAL*). The equivalence scales used in *PCEXP1* follow Ray (2000), which accounts for both household size economies and also the age-sex composition of the household.[7] Finally to account for any other unobserved heterogeneity we include three province dummies for residence in the North West Frontier Province (*NWFP*), Sindh (*SINDH*) and Baluchistan (*BALUCH*).[8]

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[6] The data on the father of each child was obtained by matching each mother to her husband.

[7] See Ray (2000), Page 249, Table 4.

[8] In theory, we should also be including supply side factors in the above equations, for example, the availability of hospitals, doctors, nurses and fertility clinics in the community could affect child mortality rates. However the community level characteristics capture supply side effects in 1991, when the survey was conducted, and not when the woman was having her children. As data on these variables are not retrospective in nature, it is difficult to examine the impact of these supply side factors in this study. In our estimation we include province dummies and these could help in part to capture differences in these kind of unobservable factors.

4. Results

Tables 3, 4 and 5 present the maximum likelihood Probit results for *MORTALITY*, *MORTALITY*_01 and *MORTALITY*_15 respectively. As mentioned before, two sets of results are presented. In the first we do not account for mother level unobserved heterogeneity and in the second we do. Notice that the mother level heterogeneity is always significant – indicated by the significance of η (at 1% significance level). In each case we will therefore discuss only the results with mother level heterogeneity.

Let us first turn to the probit estimates for *MORTALITY*. First a girl has a significantly lower probability of dying relative to a boy. Children of a lower birth order have a higher probability of dying – *BIRORDR* is positive and significant. Both *DIFFPREV* and *DIFFNEXT* are negative and significant indicating that increased duration between children reduces child mortality, confirming the resource constraint/sibling competition effect on child mortality. The sign of the *BIRORDR* coefficient is puzzling because it indicates that the lifecycle hypothesis is not valid for our sample. The higher the age of the mother at birth, the lower the probability that the child dies but there is a significant non-linearity in the effect of the mother's age with the probability of child death increasing significantly for older mothers. Turning to other (mother level and household level) characteristics, we find that the education of the mother and the father have significant impacts on child mortality. A child whose mother has more than primary schooling and a child whose father has more than primary schooling has a significantly lower probability of dying. There is therefore evidence of a threshold level of education that is necessary before the parental education starts having a significant effect on child mortality - more than primary schooling is necessary to have a significant effect on child mortality. This is similar to the threshold in the effect of mother's education on fertility that has been observed in the literature.[9] Children born in the North West Frontier Province and Baluchistan have significantly higher probability of dying while children born in Sindh have a significantly lower probability of dying, relative to children born in the Punjab.

Table 4 presents the probit estimates for *MORTALITY*_01. Overall the results are very similar to the results in Table 3. Once again a girl has a significantly lower probability of dying – *GIRL* is negative and significant. Both *DIFFPREV* and *DIFFNEXT* are negative and significant indicating that increased time difference between children results in lower child mortality. An increase in the age of the mother at birth (*AGEMBRTH*) significantly reduces the probability of the child dying in the age 0 - 1 and there is a non-linearity in the age of mother effect (*AGEMSQ* is positive and significant). Children whose mother has more than primary education have a significantly lower probability of dying in the age group 0 – 1, indicative of the importance of mother's education on infant mortality and the threshold effect of education.

Table 5 presents the probit estimates for *MORTALITY*_15. Notice first that *GIRL* is positive and significant and the estimates imply that a girl has a significantly higher (at 1% level) probability of dying in the age 1 – 5. The greater the time difference between a particular child and its elder sibling (*DIFFPREV*), the greater is the probability that this child dies in the age 1-5. Parental education has very little impact on child mortality in the age group 1- 5 – only father's education beyond secondary school (*EDUCF3*) and the ability of the mother to read (*MOTHREAD*) have significant effects on child mortality but even these effects are quite weak.

[9] Subbarao and Raney (1995) show that female secondary eduction has significant impact on fertility and infant mortality and the effect of female secondary education is stronger than supply side factors like provision of family planning programs. Gangadharan and Maitra (2000) find a similar threshold effect on the effect of mother's education on fertility in South Africa. Ainsworth, Beegle and Nyamete (1996) and Benefo and Schultz (1996) provide possible explanations for such a threshold effect.

While overall and in the age group 0 – 1 girls have a significantly lower probability of dying (compared to boys), our results indicate that this effect is reversed in the age group 1 – 5. Deaths in the age group 0 - 1 are not very likely to be influenced by the gender of the child as they are partly genetically determined and partly determined by prenatal care, which is perhaps the same for a boy or a girl as very few mothers would know the sex of the child. Hence gender differences emerge more clearly in the later ages (after the first birthday and before the fifth birthday) when mortality is influenced more by behaviour than by intrinsic genetic factors. This is the age group where resource allocation starts having an impact and it is quite likely that resources (including health inputs) are not adequately allocated to girls in this age group. As nutrition and medical care are very important for children in that age group, one could argue that a higher child mortality rate for girls in this age group (1 - 5) is due to skewed allocation of the above mentioned resources to girls. Most children in Pakistan in the age group 0 – 1 are breast fed by the mother (see Rukanuddin (1992)), so there are very little gender differentials in terms of resource allocation in the age group 0 – 1. Of course following the birth of a girl, parents could try to have another child earlier (a reflection of the son preference hypothesis) and we do find that in our sample the average duration to the next child is significantly greater following the birth of a son. Trying to have another child implies that the mother would stop breast-feeding the previous child hence girls would be breast-fed less than boys. However we find that an average girl is breast fed for 10 months compared to 11 months for an average boy, which implies that a girl gets roughly similar nutrition as a boy in the 0 – 1 age group. It therefore appears that active discrimination against girls begins quite early (right after she has completed her first birthday) which is reflected in the switch in probabilities in child mortality rates. The significantly higher probability of girls dying in the age group 1 – 5 (relative to boys) is therefore a reflection of discrimination against girls. Over time discrimination results in lower human capital investment in girls resulting in significantly worse educational and labour market inputs for girls relative to boys.

5. Conclusion

Most analyses of child mortality have used data on the mother to estimate the number of child deaths or the probability of child death experienced by the mother. However that has meant that important information on the specific child is not used. In this paper we use child level data from Pakistan to estimate the probability of the child dying. The probability of a child dying is assumed to depend on a set of child level characteristics and also a set of mother level characteristics, which will be common to children born of the same mother. This is known as mother level heterogeneity and our estimation accounts for this. About 87% of the women in our sample have more than one child so it is important to explicitly use this information. Our estimation results show that unobserved mother level heterogeneity is always significant and thus not explicitly accounting for it in the estimation would lead to inconsistent estimates. We find that overall girls have a higher probability of surviving and when we look at disaggregated data we find that relative to boys, girls have a significantly lower probability of dying in the age group 0 - 1 but have a significantly higher probability of dying in the age group 1 - 5. Education of the mother has a significant and negative effect on child mortality and there is a threshold level of education that the mother has to attain before education starts affecting child mortality. Additionally we find that increased duration between the births significantly reduces child mortality.

The significantly higher probability of girls dying in the age group 1 – 5 (relative to boys) is a reflection of discrimination against girls. Child deaths in the age group 0 - 1 are not as likely to be influenced by the gender of the child, as they are partly genetically determined and partly determined by prenatal care. Very few expectant women in Pakistan would know the sex of the child prior to childbirth, hence the prenatal care given to both boys and girls could be assumed to be the same. Gender differences therefore emerge more clearly in the later ages (after the first birthday and before the fifth birthday) when mortality is influenced more by behaviour than by intrinsic genetic factors. As most children in Pakistan (irrespective of gender) are breastfed until the age of one, gender discrimination is observed once the child requires additional resources like health inputs. Parents control such inputs and given that resources are limited, parents prefer to allocate a higher proportion to boys that to girls. This results in higher mortality rates among girls in this age group.

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Table 1: Selected Descriptive Statistics

Variable	N	Mean	Standard Deviation
Mother Level Variables			
RURAL	4546	0.507259	0.500002
SINDH	4546	0.266388	0.442118
NWFP	4546	0.16432	0.370607
BALUCH	4546	0.070832	0.256571
TOTCHILD	4546	4.864716	3.135018
TOTADTM	4546	2.221953	1.473719
TOTADTF	4546	2.08315	1.29181
LPCEXP1	4546	7.270398	0.671528
EDUCF1*	4546	0.189617	0.392041
EDUCF2*	4546	0.25319	0.434887
EDUCF3*	4546	0.091729	0.288675
FATHREAD*	4546	0.49714	0.500047
FATHWRIT*	4546	0.466344	0.498921
RELHDF1*	4546	0.688737	0.463061
EDUCM1	4546	0.08733	0.282348
EDUCM2	4546	0.08183	0.274136
EDUCM3	4546	0.028157	0.165438
MOTHREAD	4546	0.203916	0.402951
MOTHWRIT	4546	0.175099	0.380094
RELHDM1	4546	0.021777	0.145972
RELHDM2	4546	0.675539	0.468225
Child Level Variables			
AGEMBRTH	21801	25.63892	6.29073
AGEMSQ	21801	696.9255	350.2969
BIRORDR	21801	3.961607	2.59796
MORTALITY	21801	0.163112	0.369476
MORTALITY_01	21801	0.123435	0.328943
MORTALITY_15	21801	0.030182	0.171092
GIRL	21801	0.4814	0.499665
DIFFPREV	21801	1.842163	2.223518
DIFFNEXT	21801	1.761983	1.588778

Notes:
Father level characteristics refer to characteristics of the child’s father.

Table 2: Impact of Mother's Education on Child Mortality

Education of Mother	Aggregate Proportion	Proportion of Boys	Proportion of Girls
Mother has No Education	89.51	88.70	90.47
Highest Education of Mother is Primary School	6.06	6.06	6.07
Highest Education of Mother is More than Primary School but less than Secondary School	3.36	4.15	3.12
Highest Education of Mother is Secondary School or higher	0.75	1.10	0.34
Mother can Write	8.66	9.92	7.15
Mother can Read	10.86	11.92	9.59

Notes:
Sample includes children that have died
Numbers are for Child Mortality overall (not classified by age group)
Cell Numbers denote proportion of children dead in each category.

Table 3: Probit Estimates for *MORTALITY*

	Without Mother Level Unobserved Heterogeneity	With Mother Level Unobserved Heterogeneity
Variable	**Coefficient**	**Coefficient**
CONSTANT	0.3423 **	0.226
	(0.1583)	(0.2152)
RURAL	0.1161 ***	0.1282 ***
	(0.0198)	(0.0298)
SINDH	-0.0738 ***	-0.0877 **
	(0.0229)	(0.0341)
NWFP	0.1633 ***	0.1716 ***
	(-0.0271)	(0.0411)
BALUCH	0.1551 ***	0.1681 ***
	(0.04)	(0.06)
TOTCHILD	-0.0716 ***	-0.0691 ***
	(0.003)	(0.0044)
TOTADTM	-0.0178 **	-0.0098
	(0.009)	(0.0137)
TOTADTF	0.0596 ***	0.0571 ***
	(0.0109)	(0.0164)
LPCEXP1	0.0356 **	0.0463 *
	(0.0158)	(0.0237)
EDUCF1	-0.0227	-0.0144
	(0.0288)	(0.0435)
EDUCF2	-0.0950 ***	-0.0865 *
	(0.0351)	(0.052)
EDUCF3	-0.1148 **	-0.0995
	(0.0518)	(0.0736)
FATHREAD	0.0175	0.0167
	(0.0545)	(0.0815)
FATHWRIT	-0.0869	-0.1132
	(0.0549)	(0.0824)
RELHDF1	-0.1133	-0.1455
	(0.0785)	(0.117)
EDUCM1	-0.0347	-0.041
	(0.0466)	(0.0672)
EDUCM2	-0.1559 **	-0.1749 *
	(0.0619)	(0.09)
EDUCM3	-0.2513 ***	-0.2898 **
	(0.0963)	(0.1322)
MOTHREAD	-0.1672 ***	-0.1933 **
	(0.0589)	(0.0879)
MOTHWRIT	0.0278	0.0077
	(0.0653)	(0.0965)
RELHDM1	0.1876 ***	0.2748 ***
	(0.0655)	(0.0994)
RELHDM2	0.1739 **	0.2521 **
	(0.0809)	(0.1199)

AGEMBRTH	-0.0677 *** (0.0097)	-0.0719 *** (0.0116)
AGEMSQ	0.0009 *** (0.0002)	0.0009 *** (0.0002)
BIRORDR	0.0648 *** (0.0049)	0.0543 *** (0.0065)
GIRL	-0.0810 *** (0.0206)	-0.0818 *** (0.0221)
DIFFPREV	-0.1832 *** (0.0082)	-0.1889 *** (0.0091)
DIFFNEXT	-0.0877 *** (0.0062)	-0.0977 *** (0.0063)
η		0.4413 *** (0.0221)

Notes:
Asymptotic standard errors in parentheses;
Significance: '*'=10%; '**'=5%; '***'=1%.

Table 4: Probit Estimates for *MORTALITY*_01

	Without Mother Level Unobserved Heterogeneity	**With Mother Level Unobserved Heterogeneity**
Variable	**Coefficient**	**Coefficient**
CONSTANT	0.2612	0.2031
	(0.1698)	(0.2413)
RURAL	0.1207 ***	0.1367 ***
	(0.021)	(0.0329)
SINDH	-0.0241	-0.0468
	(0.0243)	(0.0376)
NWFP	0.1950 ***	0.2087 ***
	(0.0288)	(0.0455)
BALUCH	0.2210 ***	0.2346 ***
	(0.039)	(0.0621)
TOTCHILD	-0.0667 ***	-0.0655 ***
	(0.0032)	(0.005)
TOTADTM	-0.0054	0.0005
	(0.0096)	(0.0151)
TOTADTF	0.0455 ***	0.0439 **
	(0.0115)	(0.0181)
LPCEXP1	0.0308 *	0.0406
	(0.0172)	(0.0269)
EDUCF1	-0.0343	-0.0245
	(0.0314)	(0.049)
EDUCF2	-0.0957 ***	-0.0939 *
	(0.037)	(0.0569)
EDUCF3	-0.0533	-0.0426
	(0.0539)	(-0.0798)
FATHREAD	0.0768	0.0817
	(0.0576)	(0.0912)
FATHWRIT	-0.0716	-0.0962
	(0.0582)	(0.0918)
RELHDF1	-0.0613	-0.0595
	(0.0961)	(0.1439)
EDUCM1	-0.0367	-0.048
	(0.0474)	(0.0718)
EDUCM2	-0.2294 ***	-0.2409 **
	(0.0661)	(0.1009)
EDUCM3	-0.2559 ***	-0.2981 **
	(0.098)	(0.142)
MOTHREAD	-0.1022 *	-0.1317
	(0.0605)	(0.0952)
MOTHWRIT	0.066	0.0534
	(0.0695)	(0.1074)
RELHDM1	0.073	0.1181
	(0.0785)	(0.1219)
RELHDM2	0.0722	0.1018
	(0.0989)	(0.1474)
AGEMBRTH	-0.0740 ***	-0.0844 ***

	(0.0102)	(0.0128)
AGEMSQ	0.0010 ***	0.0012 ***
	(0.0002)	(0.0002)
BIRORDR	0.0700 ***	0.0643 ***
	(0.0052)	(0.0071)
GIRL	-0.1323 ***	-0.1434 ***
	(0.0223)	(0.0244)
DIFFPREV	-0.1973 ***	-0.2062 ***
	(0.0094)	(0.0107)
DIFFNEXT	-0.1133 ***	-0.1239 ***
	(0.006)	(0.0061)
η		0.4898 ***
		(0.0241)

Notes:
Asymptotic standard errors in parentheses;
Significance: '*'=10%; '**'=5%; '***'=1%.

Table 5: Probit Estimates for *MORTALITY*_15

Variable	Without Mother Level Unobserved Heterogeneity Coefficient	With Mother Level Unobserved Heterogeneity Coefficient
CONSTANT	-1.2551 ***	-1.5260 ***
	(0.2981)	(0.3854)
RURAL	0.0233	0.029
	(0.0352)	(0.0472)
SINDH	-0.1229 ***	-0.1337 **
	(0.042)	(0.0562)
NWFP	-0.0522	-0.0474
	(0.0481)	(0.0649)
BALUCH	-0.105	-0.1031
	(0.0717)	(0.093)
TOTCHILD	-0.0407 ***	-0.0391 ***
	(0.006)	(0.0077)
TOTADTM	-0.0445 **	-0.0402 *
	(0.0177)	(0.0234)
TOTADTF	0.0612 ***	0.0584 **
	(0.0191)	(0.0261)
LPCEXP1	0.0149	0.0212
	(0.0302)	(0.04)
EDUCF1	0.0046	0.0071
	(0.0471)	(0.0643)
EDUCF2	-0.0252	-0.0198
	(0.061)	(0.0805)
EDUCF3	-0.2995 **	-0.3090 *
	(0.1302)	(0.1596)
FATHREAD	-0.0546	-0.039
	(0.1041)	(0.1338)
FATHWRIT	-0.1354	-0.1687
	(0.1072)	(0.1369)
RELHDF1	-0.0851	-0.1106
	(0.15)	(0.1867)
EDUCM1	-0.0558	-0.0621
	(0.097)	(0.1236)
EDUCM2	0.107	0.0744
	(0.111)	(0.153)
EDUCM3	-0.2756	-0.3184
	(0.3403)	(0.3901)
MOTHREAD	-0.3032 **	-0.3250 *
	(0.134)	(0.1702)
MOTHWRIT	-0.0599	-0.0629
	(0.1483)	(0.1848)
RELHDM1	0.2065	0.3023 *
	(0.1259)	(0.1654)
RELHDM2	0.2434	0.3188 *
	(0.1524)	(0.1919)
AGEMBRTH	-0.0257	-0.0229

	(0.0187)	(0.0217)
AGEMSQ	0.0002	0.0001
	(0.0003)	(0.0004)
BIRORDR	0.0281 ***	0.0209 *
	(0.0101)	(0.0123)
GIRL	0.0990 ***	0.1139 ***
	(0.0353)	(0.0389)
DIFFPREV	-0.0798 ***	-0.0850 ***
	(0.0152)	(0.0166)
DIFFNEXT	-0.0079	-0.0125
	(0.013)	(0.014)
η		0.4562 ***
		(0.0449)

Notes:
Asymptotic standard errors in parentheses;
Significance: '*'=10%; '**'=5%; '***'=1%.

Table A1: Description of the Variables Used

Variable	Description
GIRL	= 1 if the child is a girl, 0 otherwise
BIRORDR	Birth Order of the Child
DIFFPREV	Age difference from the elder sibling
DIFFNEXT	Age difference from the younger sibling
EDUCF1	= 1 if the highest education level of the father is primary school, 0 otherwise
EDUCF2	= 1 if the highest education level of the father is more than primary but not secondary education, 0 otherwise
EDUCF3	= 1 if the highest education level of the father is more than secondary education, 0 otherwise
FATHREAD	= 1 if the father can read, 0 otherwise
FATHWRIT	= 1 if the father can write, 0 otherwise
RELHDF1	= 1 if the father is the head of the household, 0 otherwise
AGEMBRTH	Age of the mother at the time of birth
AGEMSQ	Square of the age of the mother at the time of birth
EDUCM1	= 1 if the highest education level of the mother is primary school, 0 otherwise
EDUCM2	= 1 if the highest education level of the mother is more than primary but not secondary education, 0 otherwise
EDUCM3	= 1 if the highest education level of the mother is more than secondary education, 0 otherwise
MOTHREAD	= 1 if the mother can read, 0 otherwise
MOTHWRIT	= 1 if the mother can write, 0 otherwise
RELHDM1	= 1 if the mother is the head of the household, 0 otherwise
RELHDM2	= 1 if the mother is the wife of the head of the household, 0 otherwise
RURAL	= 1 if the household resides in a rural area, 0 otherwise
SINDH	= 1 if the household resides in Sindh, 0 otherwise
NWFP	= 1 if the household resides in North West Frontier Province, 0 otherwise
BALUCH	= 1 if the household resides in Baluchistan, 0 otherwise
TOTCHILD	Total Number of children in the household
TOTADTM	Total Number of adult males in the household
TOTADTF	Total Number of adult females in the household
LPCEXP1	Log of per-adult equivalent household expenditure

Figure 1: Frequency Distribution of Total Number of Children