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Correlates of Child Mortality in Pakistan: A Hazards Model Analysis

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This study investigated factors associated with child mortality in an area in Rawalpindi, one of the large cities of Pakistan. Using both demographic and anthropological methods, the research was conducted to specifically examine the processes and mechanisms whereby a link is established between child mortality and its covariates. Controlling for the socio-economic status as a determinant of child mortality, the study population was limited to a lower income stratum living in a homogeneous environment where all households had equal access to health-related and other facilities.

Results of the proportional hazards model analysis on 1301 index children suggest that non-economic factors like maternal health-seeking behaviour were related to high child mortality. The cultural norm of bearing a large number of children was the most significant correlate. In order of significance, this was followed by contraceptive use, current age of the mother, age at marriage and the hygienic conditions of the household. The study provides strong evidence of familial clustering of mortality by order of the household.

Various studies indicate that mortality in Pakistan declined sharply in the early half of this century and the decline continued until the 1960s. Since then there has been a levelling-off in mortality, apparent in estimates of the crude death rate as well as in the infant mortality rate. According to estimates, the crude death rate stalled at a high level of 12 per 1000 population, and infant mortality rate at an unacceptably high level of 106 per 1000 live births [Sathar (1985) and UNICEF (1991)]. Statistics available for 1989 show that infant and childhood deaths constitute almost three-fourths of the total deaths in the country leading to an under-5 mortality rate of 162 per 1000 live births [UNICEF (1991)].

Until recently, no comprehensive national study on child mortality existed in Pakistan, mainly because of the lack of vital registration data necessary for the computation of trends and differentials. The available data permitted only a compilation of a series of estimates of child mortality from various cross-sectional surveys done in the 1960s and 1970s which, because of differences in method and

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sampling, were not comparable. However, a comprehensive study of child mortality was recently made using data from the Pakistan Fertility Survey of 1975 [Population Planning Council (1976)]. Child mortality rates were derived from reproductive histories collected, dating back to 35 years before the survey; this made possible the computation of trends and differentials.

Child mortality rates have been estimated, using other national socio-demographic sample surveys. These surveys collected information on vital events for the period not exceeding one year before the date of interview. Using different methods of sampling and estimation, these sources arrived at different levels of infant mortality (Figure 1), raising concern as to which one was the true estimate. Whereas levels differ substantially across the surveys, the combined evidence from the available sources indicates that there are differentials in child mortality by education, more specifically maternal education, by province and urban and rural breakdown with higher rural than urban rates. These mortality differentials have commonly been attributed to the socio-economic well-being associated with the availability of health and other facilities. Although most health services are concentrated in urban areas and are better equipped than those in rural areas, Sathar (1985) found that urban mortality was not very different from that of the rural areas. Using the Labour Force and Migration survey of 1979, Sathar found that for the

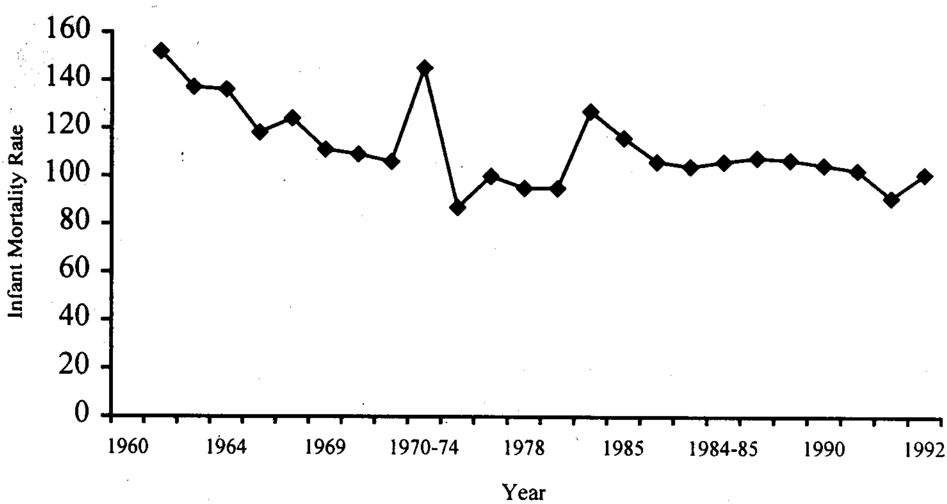

Fig. 1. National Infant Mortality Rates for Pakistan, Various Sources.

Source: Pakistan Growth Estimation Surveys: 1962, 1963, 1964, 1965.
Population Growth Surveys: 1968, 1969, 1970, 1971, 1970–74, 1976, 1977, 1978, 1979.
Pakistan Demographic Surveys: 1964, 1985, 1986, 1987, 1988, 1989, 1990, 1991, 1992.
Pakistan Contraceptive Prevalence Survey: 1984-85.
Pakistan Demographic and Health Survey: 1990-91.

period 0–14 years before the survey (1965–79), the estimated mortality rate for children aged 1–5 years was 41 per thousand for urban areas and 48 for rural areas. This shows that the urban-rural differential or the provision of health services on its own is inadequate to explain the mortality levels of Pakistan and that there may be other factors contributing to lower mortality rates. Similar results have been found in many other developing countries which show that when the effects of variables like female education, environmental conditions or other demographic factors are controlled, the pattern of urban-rural differential is reversed [Caldwell and McDonald (1981); Chamratrithirong (1982); Trussell and Hammerslough (1983)]. Taking the example of education, almost all nationwide studies conducted in Pakistan indicate the inverse relationship between female education and child mortality, yet no attempt has been made to go one step further to investigate the social significance of education and the underlying mechanisms through which it might operate to affect the health status of children below the age of five. Investigations in several other countries suggest that education has a positive impact on the health-seeking behaviour of mothers. Rising levels of maternal education alter complex social and cultural influences such as health beliefs, lifestyle, perceptions of illness, the treatment sought and the necessary actions taken, which largely determine the levels of morbidity and mortality [Caldwell (1979); Basu (1989, 1992); Das Gupta (1990); Bhuiya, Streatfield and Sarder (1993)].

In view of the dearth of indepth analysis on child mortality in Pakistan, this study was specifically conducted to: first, identify some of the major covariates of child mortality amongst children less than five years; and second, to evolve some of the processes and the underlying mechanisms through which a relationship is established between child mortality and its covariates. The basic purpose was to elucidate the 'cause and effect' relationship for any optimal policy direction and thereafter, effective implementation of the policies formulated.

MATERIALS AND METHODS

For this study, three data sets were generated from an area in Rawalpindi city, Pakistan, in the first half of 1992. The data sources were a quantitative survey, a qualitative survey, and a Health Care Provider Survey. The study area, located in one of the largest cities of the country, is provided with all the basic amenities of living, such as access to piped water, sewerage and a variety of health and educational facilities. The area was purposely chosen to focus on the target population belonging to a low-income stratum so as to be able to control, to a large extent, the impact of socio-economic status as a determinant of child health. The other factor considered for choosing this area was the expected heterogeneity of ethnic, religious and other socio-demographic characteristics.

Using a non-probability and purposively selected sampling technique, 341 ever-married women who had at least one child below the age of five years were included in the study to obtain information on socio-economic, demographic, environmental and behavioural factors. For conducting mortality analysis, a complete birth history, including the survival status of each child, was obtained from each mother. The information obtained identified a total of 1,301 children ever born in the period up to 22 years before the survey time. These children constituted the universe of the index children to examine the risk ratios and survival status before the fifth year of life was completed, cross-classified by the socio-economic and other health-related factors to identify the causes of child deaths.

The objectives of the study were achieved through the following three steps:

1. Univariate Cox proportional hazards models were fitted for each of the independent variables of interest to obtain parameter estimates for hazard ratios and examine their level of significance.
2. Based on the fitted parametric functions to the data, multivariate Cox proportional hazards analysis was conducted for the estimation of several covariates effects simultaneously.
3. A multivariate model was fitted to examine the interaction effects of the covariates.

The covariates were grouped into four broad categories: socio-economic factors, environmental and hygiene factors, demographic factors and health programme factors. Each independent variable was divided into two or more levels depending on the number of cases and the best combination of various subdivisions to obtain fixed categorical effects for the final analysis. The percent distributions of the children under observation by each of the variables included in these four categories are given in Appendices of Table A1 to A4.

Proportional hazards model was used after exhausting other available techniques. For example, survival probabilities during the first four years of life, based on non-parametric Kaplan-Meier estimates of survivor function were examined. Also, an attempt was made to split the data into three different groups by year of birth to observe any comparable differences in the cumulative survival probabilities and measure any changes in mortality levels over time. Analysis was terminated as there were hardly any differences in the survival probabilities of children in the three cohorts created. Using the World Fertility Surveys for 29 countries conducted during 1975, Rutstein (1983) had found that several countries including Pakistan had an increased under-five mortality in the most recent period over that of the period 5–9 years before the survey and that these countries had fluctuating mortality rates within an overall declining trend observed in the 20 years before the survey.

In any case, complete reliance on the above mentioned statistics would have been misleading since these estimates would be subject to sampling errors and other random fluctuations; therefore in order to examine in detail the differences in the distributions, Cox's proportional hazards model [Cox (1972, 1975)], using a semi-parametric approach and the method of maximum partial likelihood was employed for final analysis using EGRET procedure. In the final child survival analysis, the joint distributions of all the observations were used to maximise the log partial likelihood in the proportional hazards model. The model used takes into account the multiplicative effect of the explanatory factors on the hazards functions and includes the censorings and the failures. In the proportional hazards model, the hazard function is given by:

$$h(t;z) = \lambda(t)g(z;\beta) \text{ with } g(z;\beta) = exp(z^T\beta)$$

where

z = is a vector of explanatory variables, β is a vector of regression parameters,

(t) = is the baseline hazard function.

The log-partial likelihood is the Cox's model is given by:

$$l = \sum_{i=1}^{n} D_i[z_i^T\beta + \ln\sum_{j=i}^{n}\exp(z_j^T\beta)]$$

where D_i is the censoring indicator $\begin{cases} 0 \text{ for censoring} \\ 1 \text{ for death} \end{cases}$

Note: the index i here is based on an ascending order reordering of the failure/censoring time.

β is estimated by maximising the log-partial likelihood function.

Using the categorical variables constructed, univariate hazards models for each of the independent variables of interest were fitted to obtain parametric estimates of the hazard ratios (see Table 1).

RESULTS

Univariate Effects

The main effects of the univariate analysis of the risks of child death are given in Table 2. These results were obtained by fitting a separate model for each of the covariates considered. The statistical significance of every variable was assessed on the basis of the overall maximum likelihood ratio with the associated degrees of freedom obtained as a result of the scaled deviance on fitting the model.

Of the total models fitted, figures in the table show that nine variables were statistically significant at the level of five percent. The results of each significant variable are discussed under the four broad categories: socio-economic, environmental and hygiene, demographic, and health programme factors.

Table 1

Univariate Hazards Models for Selected Variables on Child Mortality (N=1301)

Model	Scaled Deviance	Likelihood Ratio	Degrees of Freedom
Null	1853.40	–	–
Mother's Past Residence	1848.30	5.10*	1
Mother's Present Residence	1853.37	0.03	1
Religion	1851.36	2.04	1
Mother's Occupation	1853.11	0.29	1
Father's Occupation	1852.92	0.48	2
Mother's Education Status	1847.30	6.10*	2
Father's Education Status	1845.86	7.54*	2
Total Household Income	1852.90	0.50	2
Type of Toilet	1849.51	3.89*	1
Type of Garbage Container	1849.33	4.07*	1
No. of Rooms in the House	1849.16	4.24*	1
Possession of Television	1853.30	0.09	1
Possession of Refrigerator	1851.69	1.71	1
Child's Sex	1853.40	0.00	1
Children Ever Born	1834.60	18.80*	3
Birth Order	1850.35	3.05	3
Birth Interval	1838.74	14.65*	3
Mother's Age at Birth	1849.51	3.89	2
Mother's Current Age	1847.65	5.75	4
Mother's Age at Marriage	1848.31	5.09	2
Contraceptive Use in Past	1844.39	9.01*	1

Source: Child Health Survey, Rawalpindi, 1992.
* Significant at 5 percent level.

Table 2

Main Effects of Univariate Hazards Models for Selected Variables on Child Mortality (N=1301)

Variables	Coefficient	Standard Error	*P*-value	Hazards Ratios
Mother's Past Residence				
City	–	–	–	1.00
Village	0.395	(.175)	0.02	1.48*
Mother's Education Status				
No Education	0.661	(.289)	0.02	1.94*
1–8 Years	0.5	(.316)	0.11	1.65
9+ Years	–	–	–	1.00
Father's Education Status				
No Education	0.532	(.212)	0.01	1.70*
1–8 Years	0.487	(.231)	0.04	1.63*
9+ Years	–	–	–	1.00
Type of Toilet				
Flush	–	–	–	1.00
Without Flush	0.385	(.201)	0.06	1.47
Type of Garbage Container				
Covered Bin	–	–	–	1.00
Open Container	0.369	(.186)	0.05	1.45*
No. of Rooms in House				
1 Room	0.366	(1.76)	0.04	1.44*
2 Rooms	–	–	–	1.00
Children Ever Born				
1–2	–	–	–	1.00
3–5	0.609	(.380)	0.11	1.84
6–8	0.859	(.387)	0.03	2.36*
9–11	1.438	(.398)	<.001	4.21*
Birth Interval				
1 Year	0.956	(.351)	0.01	2.60*
2 Years	0.498	(.351)	0.16	1.65
3 Years	–	–	–	1.00
0 or 4+	0.177	(.359)	0.62	1.19
Mother's Current Age				
15–19 Years	0.328	(.756)	0.67	1.39
20–24 Years	–	–	–	1.00
25–29 Years	0.505	(.306)	0.10	1.66
30–34 Years	–0.094	(.977)	0.98	0.99
35–39 Years	0.298	(.308)	0.33	1.35
Mother's Age at Marriage				
12–19 Years	–	–	–	1.00
20–24 Years	–0.286	(.219)	0.19	0.75
25–31 Years	0.499	(.297)	0.09	1.65
Contraceptive-use in Past				
Users	–	–	–	1.00
Non-users	0.531	(.179)	0.00	1.70*

Source: Child Health Survey, Rawalpindi, 1992.

* Significant at 5 percent level.

Socio-economic Factors

The univariate models under this heading show that past residence of the mother and educational attainment of both the father and the mother were associated with the survival probabilities of the children in the study area.

Place of Residence

The analysis for this study was conducted on both the past and the current residence of the mothers to examine any difference in child mortality which could be explained in terms of behavioural differences resulting from childhood residence. The results show that children whose mothers spent their first twelve years of life in a village were around 1.48 times more at risk of death than children whose mothers spent their initial years of life in the city, suggesting that change of residence to a city had not necessarily altered the mothers' traditional behaviour and beliefs relating to general health. Even though interviews with these women confirmed that almost all women had easy access to the health services and used them, their beliefs about childhood diseases seemed to be influenced by the traditional knowledge and curative methods adopted. There was however, no statistical difference between the child mortality experience of women who had lived in the current place of residence for up to 25 years and those who had lived there for less than 11 years.

Parental Education

Studies in numerous developing countries suggest that education, especially that of the mother, is strongly correlated with child survival. Univariate analysis conducted for this study also shows that survival of the children under five years was associated with the educational attainment of both the mother and father. The main effects of the results for mother's education reveal that children of mothers who had never attended a formal school had almost twice the risk of dying than children whose mothers had attained nine or more years of schooling. There was, however, no significant difference between the child mortality probabilities of mothers who had attended school up to Grade 8 compared with those who received higher education. The analysis also shows a relationship between the survival probabilities of children and the educational attainment of the father. The figures in Table 2 show that children of fathers with no education were about 1.70 times more at risk of dying than those whose fathers had attained higher-level education. Interestingly, children of fathers who had received education up to Grade 8 were also found to be 1.63 times more at risk of death than those in the reference category. The results suggest that the risk of child death was only marginally different for children belonging to the uneducated and those whose fathers had reached Grade 8: a minimum of nine years of father's schooling was needed to have any effect on child survival.

Thus, mother's education had a stronger impact on the survival of the index children than that of fathers, in that, there was no statistical difference between the survival of children of mothers with higher or lower educational attainment. These results show that even a few years of mother's schooling can help improve child survival and significantly lower the death rate of children in their early years of life. These findings are consistent with those found in several other countries and support the hypothesis [Caldwell (1979)] that the mother first notices a child's ill-health and does something about it, and therefore if she is educated and free to act, the chances are greater that something will be done; whereas even if the father is educated and autonomous, his impact on child survival is smaller because he is less likely to be in a position to notice the ill-health in the first place.

Hygienic and Environmental Factors

The variables used for measuring the household's hygienic environment were the type of toilet used, the mode of garbage disposal and the number of rooms per household. While the basic physical environment is the same within which the mortality differential is sought, results suggest that differences in household practices of sanitation and hygiene, which affect the transmission of infecting agents, lead to differences in the levels of potential exposure to various illnesses.

All the three variables had an independent effect on child survivorship. Although marginally different from each other, results show that children in households with a toilet without flush were 1.47 times more likely to die than children in households with a flush toilet. In households with an open garbage container, the risk ratio of the children was 1.45 times higher than in households with a covered garbage bin.

Association of child death with unhygienic living conditions and cross-infections as a result of crowding are also confirmed by the total number of rooms in the household. Table 2 shows that children living in households with only one room were 1.44 times more likely to die than children living in households with two or more rooms. In most of the houses with one room, the general trend was to cook, eat and sleep in the same room. The number of family members in households with one room can be used as a relative measure of the effect of crowding. On an average, there were six to nine household members sharing the facility. Observations of these households, however, suggest that regular visitors compounded the effects of crowding.

Demographic Factors

Of the demographic variables, the number of children ever born and the length of the birth interval were factors strongly correlated with the risk of child death.

Children Ever Born

Univariate analysis shows that high-fertility households experienced higher levels of mortality than low-fertility households. Table 2 shows that the risk of death increases progressively with the increase in the number of children ever born. The highest risk of death was amongst children in households with nine or more births leading to a risk ratio of about 4.21 compared to those in households with only one or two children. The declining gradient demonstrates that the risk of dying was 2.36 in households with six to eight children and statistically insignificant for children in households with three to five children when compared to the reference category.

Although the univariate model presents the independent association of the two statistically significant variables, the number of children ever born is strongly influenced by other demographic and socio-cultural factors. For instance, the steady increase in the average parity by age of the mother is a normal function of the family building process yet the differentials in parity can largely be a function of the interrelationship between child mortality and fertility [Preston (1978)]. For example, in high-mortality countries, families who experience many child deaths or expect a high proportion of children to die, may have more children than they would if they expected all the children born to survive [Saksena and Srivastava (1984)]. Death of a child can expose a woman to early conception, in the absence of contraception, as a result of cessation of breastfeeding leading to shorter postpartum amenorrhoea. Child death can also serve as a motivation for early conception in the case of parents who are anxious to replace the lost child. [Suchindran and Adlakha (1984).]

Other socio-cultural differences can be explained in terms of interlinked competition of resources between the children, such as lack of maternal health care attention, improper and deficient breastfeeding and nutrition, lapsed morbidity due to repeated contraction of infections and improper medical attention or simply an innate fragile health because of biologically carried effects due to maternal depletion syndrome. These factors are discussed in detail below.

Birth Intervals

A large number of analyses conducted by using the World Fertility Survey data provide evidence of the strong association between short birth intervals and child mortality [Rutstein (1983); Hobcraft *et al.* (1984, 1985)]. The effect of birth interval may relate to either the previous child or the new baby. Here the case of the preceding birth interval is entailed. The univariate results show a very clear negative association between child survival and birth interval between the preceding and the succeeding child. The results show that children born at an interval of one year were at the greatest risk of death with a risk ratio of 2.60 compared to children born about three years apart. There was no association between spacing and death for children born after an interval of two or more years.

Differences in birth intervals by the education of the mother indicate that the number of children born within a short birth interval decreases with maternal education. Around 54 percent of the children born at a short birth interval of a year belonged to mothers who had never been to school while 29 percent and as low as 17 percent of the short-interval-born children were borne by mothers who had attained up to eight years and higher level of education, respectively (see Appendix Tables 5 to 7).

Maternal Age

The independent effect of age at marriage and the current age of the mother can have both independent and combined effects on the mortality of children below the age of five. The effects of these two variables in this study show that none of these variables were independently associated with higher child mortality. Their combined effects with other demographic variables are further examined in the multivariate analysis.

Health Programme

Ever-use of a family planning method is shown to have a positive effect on survival status in early childhood resulting in a risk ratio of 1.70 for children born to mothers who had never used any family planning method in the past compared to the user-mothers. One of the important effects of use of contraception in high-fertility countries is the lengthening of the spacing between births, increasing the survival chances of the children at both ends of the interval. Hobcraft *et al.* (1985) argue that shorter birth interval and high risks of child death are intertwined in that shorter birth interval leads to high risk of death, and higher risk of death leads to shorter birth interval. Thus, in the event of a child death and early cessation of breastfeeding, the resumption of ovulation is accelerated and in the absence of the use of contraception could lead to the next pregnancy which could result in a stillbirth, or a premature or under-weight baby [Wolfers and Scrimshaw (1975)]. These factors are strongly related to the depleted physical resources of the mothers who did not get enough time to recuperate from the drain of the last pregnancy.

Thus, not only can contraception be used for longer birth intervals, it can be one of the important tools for lowering fertility and consequently the mortality levels in the developing countries. In almost all the developed countries, the increased use of contraception is perhaps one of the major determining factors lowering fertility and mortality levels and leading to healthier populations.

MAIN EFFECTS OF THE MULTIVARIATE MODEL

In order to control for the possible correlation between these variables or the confounding effect of one over the other, multivariate proportional hazards models were fitted for identification of covariates which comparatively had a stronger relationship with the survival probabilities of the children under observation. The model was gradually built by adding one variable at a time. The inclusion or exclusion of each variable was determined by the overall likelihood ratio and its associated degrees of freedom. The significance of each inclusion, in terms of the comparative distributions of hazards ratios, depended on the values of the estimated parameters and their standard errors. Based on these values, the stronger or the weaker effects of the variables upon addition of a new variable were also noted. To begin with, the most significant variable, children ever born, was first fitted into the model. The second most important variable included in the model was the birth interval followed by the use of family planning method in the past. The results showed that children born within an interval of one year were 2.39 times more at risk of dying than children born within an interval of three years.

However, when the current age of the mother was included in the model, the effects of birth interval on the survival probability became weaker to the point of crossing over the 5 percent level of significance. The weakened effects of the variable 'birth interval' suggests that the birth interval effects and the survival probability of the child were more strongly correlated with, and were largely dependent on the use of family planning method and the age of the mother, with children of younger mothers being more at risk of dying compared to a greater number of children born and surviving to mothers aged 30 years and above.

The variable was dropped from the model and the whole process of fitting the variables continued to obtain a final model retaining only those variables which met the criterion of the above mentioned significance level. In Table 3 the final

Table 3

Main Effects of Multivariate Hazards Model on Child Mortality (N=1301)

Variables	Coefficient	*Standard Error	*P*-value	Hazards Ratios
Children Ever Born				
1–2	–	–	–	1.00
3–5	1.005	(.397)	0.01	2.73*
6–8	1.615	(.442)	<.001	5.03*
9–11	2.844	(.534)	<.001	17.18*
Contraceptive Use in Past				
Users	–	–	–	1.00
Non-users	0.469	(.181)	0.01	1.60*
Mother's Age				
15–19 Years	0.425	(.759)	0.58	1.53
20–24 Years	–	–	–	1.00
25–29 Years	0.097	(.327)	0.77	1.10
30–34 Years	–0.817	(.369)	0.03	0.44*
35–39 Years	–1.314	(.430)	0.00	0.27
Mother's Age at Marriage				
12–19 Years	–	–	–	1.00
20–24 Years	0.110	(.234)	0.64	1.12
25–31 Years	1.566	(.361)	<.001	4.79*
Type of Garbage Container				
Covered Bin	–	–	–	1.00
Open Container	0.449	(.191)	0.02	1.57*

Source: Child Health Survey, Rawalpindi, 1992.

* Significant at 5 percent level.

multivariate model built is presented, showing the parametric estimates, their standard errors and their significance level, based on the two-tail normal distribution z statistic, of the five most important covariates. Out of the five variables included in the model, mother's current age at the time of the survey and mother's age at marriage, which were statistically insignificant as independent variables, gained new importance in the multivariate model.

Children Ever Born

So far the most significant variable in the univariate analysis was the number of children in each household, which affected the survival chances in childhood. Retaining its importance as the most significant factor, its effect on child survival is further attenuated net of the effects of the other variables in the multivariate model. Table 3 shows that children in households with a total of 3 to 5 children ever born were at about 2.73 times the risk of dying as children in households with up to 2 children ever born (the reference category). This pattern was not apparent in the univariate model in which there was no statistically significant difference in the death risk ratios for children in the above two categories. This pattern emerged only when the age of the mother was entered, increasing the risk ratio to more than half in each of the categories showing the ascending number of children ever born. The impact of the age of the mother was more pronounced for the households with 9 or more children born. The effects were further compounded with the age of the mother at marriage and the general hygienic conditions of the household measured by the mode of garbage disposal. The final model fitted shows that children belonging to households with a total of 9 to 11 children ever born were as much as 17.18 times more at risk of death than children living in households with only one to two children. For children in households with 6–8 and 3–5 children the risk ratios were 5.03 and 2.73, respectively.

Around 20.3 percent of all the children included in the study were born at an interval of one year and as the results presented earlier demonstrate, were at the greatest risk of dying. Such a short birth interval affects the survival of both the preceding and the succeeding child. Similar findings have been reported elsewhere, that not only is the preceding child taken off breastfeeding earlier but competition between maternal and other household resources and maternal depletion syndrome plays a major role in the survival of the sibling. Mothers with depleted biological resources tend to give birth to premature, underweight and small babies whose survival could be at risk from the day of the birth. As more than 70 percent of the women in the study area gave birth at home, there was no way for the mother to verify if the baby was underweight so it could be treated differently in terms of nutrition and greater maternal care.

In the present study there was no differential by birth order. This finding was not only confirmed in the univariate analysis but even after the effects of other variables were controlled for in the multivariate model, the results remained unaltered showing no differential in child survival for either the first or the higher-order births. The multivariate analysis on 39 countries (also Pakistan) included in the World Fertility Survey by Hobcraft *et al.* (1985) showed no variation in risks for any mother for birth orders 4–6, nor for those of order seven or higher. The association with higher risk was found for the first-born only.

Cross-classifying the birth order by the age of the mother at childbirth revealed (Appendix Table 8) that of the total number of 341 children of first birth order, 84 percent were born to mothers whose age at birth was between 12 and 24 years. This is consistent with the fact that 58 percent of the women in the study area were married by the age of 19 and a high 92 percent of the total women were married by the age of 24 years. Thus, it is possible that the birth order effects are confounded by period effects in that the number of first births to younger mothers may have been under-estimated as compared to the higher birth orders to older women occurring in the most recent period before the survey.

Although the inexperience and biological inadequacy of the younger mothers of first babies and the effects of age and maternal depletion associated with higher birth orders may have their impact on the overall mortality level, the higher risk of death in households with a large number of children ever born is best explained in terms of the synergistic impact of the generally unhygienic conditions leading to cross-infections, competition for resources, and lack of maternal care and attention needed for the better survival of the child.

The differentials in child survival by the number of children ever born can also be explained by the education level of the mother. Table 9 in the Appendix shows that a large number of mothers with higher education had upto 2 children and the percent declines progressively with the increase in the number of children ever born. In the category of 6 to 8 children only about 10 percent of the children were born to mothers with higher education compared to 62 percent of the children born to uneducated mothers in the same category. As many as 88 percent of the children in the category of 9 to 11 children were born to mothers with no education, and around 12 percent to mothers with some education. Not a single mother with higher education had given birth to such a large number of children. Although the overall number of children ever born is still high, the univariate analysis of child survival by mother's education shows that these women had the lowest rate of child deaths. The results signify that, lower fertility in associated with lower mortality and maternal education has significant implications of fewer childbirths and fewer child deaths.

Use of Family Planning Method

The multivariate analysis shows that children born to mothers who had never used family planning in the past were around 1.60 times more likely to die than children born to mothers who had ever used family planning. The higher number of infant deaths amongst the non-users can be explained by the greater number of children born at shorter birth intervals with a greater risk of death. In the event of the death of the succeeding child, the replacement of the dead child by another pregnancy is once again exposed to factors which are adverse to child survival.

The use of family planning is encouraged in the study area through visits of family welfare teams. In-depth discussions with the respondents gave an impression of the keenness and interest of a large number of women in the use of family planning but these respondents and their male household members revealed the adverse attitude of many males to contraception. There are examples of women who had used some method of family planning without the knowledge of their husbands.

Taking the absolute number of mothers who ever used a family planning method, out of the total 166 (49 percent) women, most had either used condoms only, or used this method in combination with some other from time to time. A total of 33 women had undergone tubal ligation and some were planning to do so. Only one male was reported to have had a vasectomy. Results show that the use of family planning increased with the age of the mother and almost all women having undergone tubal ligation were older women who had attained their desired family size. These women had borne a total of eight or more children and used contraception either to delay the next pregnancy or terminate childbirth.

The differences in the use of family planning by the education of the mother show that 67 percent of the children were born to user-mothers who had received higher education. About 62 percent belonged to mothers with 1 to 8 years of schooling and 40 percent were born to those with no education (see Appendix Table 10). It should be noted that educated women and comparably fewer children born and had experienced fewer child deaths than the uneducated with a large number of children born at relatively short intervals in the absence of contraception. The differences are encouraging and show that educated women are more likely to adopt contraception. The higher the education, the higher is the acceptability and use, whereas the uneducated seem barred by cultural forces.

Maternal Age and Parity

As is well known, a strong correlation exists between infant mortality and the age of the mother at the time of childbirth. Numerous studies show that mortality is high for very young mothers, falls to the lowest for women aged between 25 and 30 and then rises steadily with the age of the mother. Analysis for the present study did not show an association between child survival and mother's age at birth, instead it reveals that mother's current age at the time of the survey and parity had a significant impact on the survival probabilities of the children aged under five. Results obtained in the multivariate model show that children of mothers in the age groups 30–34 and 35–39 were 0.44 and 0.27 times less likely to have died than children of mothers aged 20–24 years even though the children of the former categories were of higher birth orders. Similar results have been reported by Hobcraft *et al.* (1985) who found no evidence for increased death risks for children born to mothers at older ages.

The observed lower risks for children born to older mothers can have various reasons. Older women as shown above were more likely to use contraception than younger women who, though they did use contraceptives, show an overall effect of being more likely to abstain from using them to attain the desired level of fertility. The use of contraception is more pronounced among educated women than the uneducated. The cross-classification between mother's level of education and mother's age shows (Table 11 in Appendix) that not a single mother with higher education was in the age category of 15–19 years. The percentage of children born to mothers with higher education increases with age to 13 percent children born to mothers aged 20–24 years, and 23 percent to mothers aged 25–29 years, and then declines slightly to 21 percent for women aged 30–34 and 14 percent to women of ages between 35 and 39. Out of these, about 52 percent of children belonged to women with higher education who were married at the ages of 25–31 years, 39 percent to mothers aged 20–24 years and as few as 6 percent to mothers aged 12–19 years compared with 29 percent, 37 percent and 64 percent of children born to uneducated women in the respective categories (Appendix Table 12). Thus educated women were more likely to be married late and so had a shorter reproductive span. They were likely to have fewer children. The use of contraception not only led to fewer children but longer birth intervals. The overall effect was lower death risk ratios for children born to these women.

Other older women (mostly uneducated), on the other hand, had experienced a higher rate of childbirths and deaths. However, recent children born to these older women were more likely to have been born after a longer birth interval as a result of contraceptive use and the advantages attached to it. Taking into consideration the cumulative effect of older ages, it could be said that recent children born to older women tend to receive better care and attention. The greater physical unsuitability of birth at a late age is somewhat compensated by improved knowledge, experience and greater ability in child-care. These women, as observed in many cases, were also likely to have abundant assistance from their older children past the age of five years, and from other relatives.

When the current age of the mother was fitted into the model the effects of birth spacing, which was the second most significant variable in the model, became weaker and were largely removed. This did not mean that birth spacing lost its significance; in fact the impact of birth spacing on child survival was replaced by the variable 'contraceptive-use in the past' which served the purpose of birth spacing. Older women in the study area were more likely to use contraception than younger women and mothers aged 30 years and above were less likely to have experienced child death than younger mothers. These women also include those who had attained higher education and were married at relatively late ages. Thus, children born to older women (current age) were at less risk of death as they were more likely to be born after a longer birth interval. The effect of longer birth spacing in itself minimises the risk of child death, and combined with better child-care as a result of the greater experience and knowledge of the older women, leads to the pattern observed in the multivariate analysis. Hobcraft *et al.* (1985) also found that when birth spacing was controlled the apparent risks associated with older mothers were largely removed and other confounding factors perhaps mediated.

Age at Marriage

The multivariate results also show that of women who married between the ages of 25 and 31 years, the children were 4.79 times more likely to die than children of mothers married at ages between 12 and 19 years. Around 67 percent of the children were born to women married at the age of 12–19 years, out of which 54 percent of the children belonged to women whose current age was 30 years and above. Clearly, most of the women who married at older ages had a smaller number of children ever born, of the total of whom 19 percent belonged to mothers aged 30 years and above (Appendix Table 13). Thus, the mortality risk of the children of these women was more recent, based on fewer women and perhaps over-estimated as compared to children who were born to women married as early as 12–19 years. This is verified by the fact that 52 percent of the children born to women married at the age of 25 to 31 years were those who had attained higher education with the highest cumulative probability of survival (Appendix Table 12).

Garbage Disposal

Lastly, the type of garbage disposal used, which largely measured the hygienic conditions of the household, was found to be associated with the survival probabilities of the children in the study area. Its significance was emphasised both in the univariate and the multivariate models. However, the estimates of the multivariate analysis show that its effect on the risk of child death was stronger in combination with other variables. The results show that children in households with an open garbage container were around 1.57 times more likely to be at the risk of death than children living in households with a covered garbage bin. It should be noted that in the univariate models, all the three environmental and hygienic variables considered for this study were found to be significantly associated with child death and as demonstrated in the multivariate model, the type of garbage disposal had the strongest effect on child survival.

As described earlier, unhygienic living conditions are a major source of spreading infectious diseases. The most likely subgroup of the population readily susceptible to contracting these infections is children, both in the neonatal period, when the immune system is not fully developed, and in the post-neonatal period. For the present study, it could be generalised that the overall hygienic conditions of the area were below average. Within the households, where the garbage was put in a container and left exposed to the environment obviously attracted flies and other insects to easily spread infections amongst the household members. Once a child caught an infection, cross-infection to other children was almost inevitable, especially amongst the undernourished and weak and those in households with a large number of members or children living in small, congested houses. All these factors are likely to lead to a higher risk of child death. There were many families in the study area which had only one room used for sleeping, eating or any other indoor activity. Thus, in a household where the risks of child death are high, other living children can be at a higher risk of dying because of exposure to the same environment.

In the analysis of the World Fertility Surveys, Hobcraft *et al.* (1985) found higher excess risks for children born after intervals of less than two years and concluded that early deaths interrupted breastfeeding, giving way to accelerated resumption of ovulation and thus leading to shorter birth intervals. They argued, however, that poor spacing was not exclusively responsible for the high risk of death as their findings also revealed that excess risk of death also existed for children born between two and four years before the index child had died. They indicated similar mortality effects relating to the family based on the assumption that there were large differences between the risks of dying in different families, and were of the same order of magnitude as the impact of a short previous birth interval. Wolfers and Scrimshaw (1975) also found that the probabilities of dying of children within the family are correlated.

For the present study, the statistically significant association of garbage disposal with the higher risk of death provides a plausible explanation of cross-infections amongst children within the family. If one child within the family was at a high risk of morbidity and consequently mortality, it is likely that other young children could experience the same and therefore raise the risk of deaths within the family. This could specifically be an important fact in the event of the mother's low level of awareness and knowledge about childcare involving cleanliness and other sanitary requirements and more specifically the ability to make proper use of medicine and other health services. In-depth discussions with respondents in the survey area showed that many mothers were not likely to notice or care for a child's illness till the child became seriously ill; many would purchase medicine directly from a pharmacist without a proper prescription from the doctor; the medicine given to one sick (or dead) child, not necessarily the correct drug, was probably given to other children in the family, who had contracted the infection and illness, putting the child at increased risk of death.

INTERACTION EFFECTS OF THE COVARIATES

Interactions between each of the variables included in the four broad subgroups, i.e., socio-economic, environmental and hygienic, demographic, and health programme were examined to test for any differences and interactions between the factorised variables. Taking one variable from each subgroup, interactions were fitted in the model for every variable in the other subgroups and the process continued till all possible bivariate combinations were examined. The same method described and used in the preceding sections was adopted to obtain a final multivariate model with the interaction terms of the most significant combinations. The estimated parameters obtained for all the interaction terms are presented in Table 4. The graphical presentation of each interaction is shown in Figures 2 to 5.

Table 4

Main Interaction Effects of Bivariate Combination in the Multivariate Model on Child Mortality

Variables	Coefficient	Standard Error
Contraceptive Use		
Users	–	–
Non-users	0.806	0.243*
Mother's Past Residence		
City	–	–
Village	0.339	0.309
Mother's Age at Birth (Years)		
14–19	0.870	0.321*
20–29	–	–
30–39	0.582	0.401
Mother's Age (Years)		
15–29	–	–
30–39	1.363	0.614*
Mother's Present Residence (Years)		
0–10	0.355	0.437
11–25	–	–
Children Ever Born		
1–3	–	–
4–6	0.885	0.295*
7–11	1.290	0.481*
Non-users and Mother's Age at Birth (14–19)	–1.099	0.431*
Non-users and Mother's Age at Birth (30–39)	–1.006	0.544
Village Mothers and Present Residence (0–10)	0.896	0.382*
Present Residence (0–10) and Mother's Age (30–39)	–1.147	0.481*
Children Ever Born (4–6) and Mother's Age (30–39)	–1.820	0.536*
Children Ever Born 7–11 and Mother's Age (30–39)	–0.998	0.621

Source: Child Health Survey, Rawalpindi, 1992.
* Significant at 5 percent level.

Use of Family Planning and Mother's Age at Birth

The interaction between the two variables suggests a curvilinear and a cross-over effect between the users and non-users of family planning in the past. Amongst the users, children of mothers whose age at childbirth was 14–19 were at greater risk of death (2.39) than children of mothers who gave birth at 20–29 years. The death ratio for children of mothers at higher ages at birth, ranging from 30 to 39 years, was also quite high (1.79) compared to those in the reference category but was lower (0.75) than the death ratio for children of mothers less than 20 years of age. Amongst the family planning users, children of mothers aged 20 to 29 years were at the lowest risk, the death ratio for children of non-user mothers in the same age category was the highest at 2.24 and lower for the youngest and the oldest age group with risk ratios of 1.79 and 1.46, respectively. Amongst the non-users, children of mothers aged 14–19 years were 0.80 times less likely to die than children of non-user mothers aged 20–29 years. Children of non-user mothers in the age category of 30–39 years were at 0.65 times lower risk of death than children belonging to younger non-user mothers aged 20–29 years.

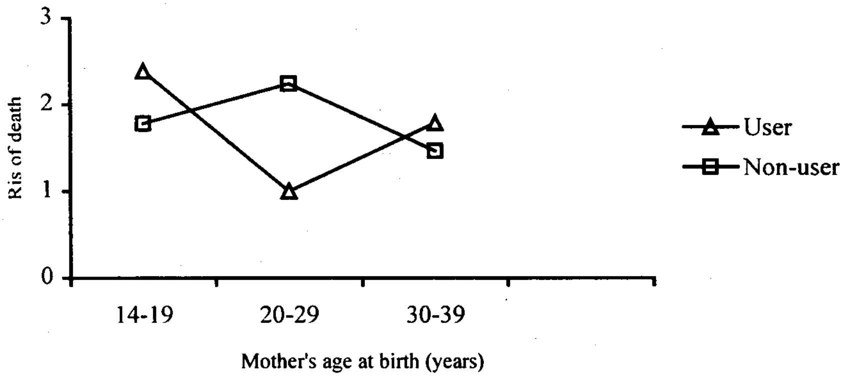

Fig. 2. Risk of Child Death by Contraceptive Use and Mother's Age at Birth.

Source: Child Health Survey, Rawalpindi, 1992.

Comparisons across the user and non-user mothers in different ages at child birth reveal that the death ratio remains high for children of non-user mothers aged 20 to 29 years. Children of non-user mothers aged 14–19 years at birth were 0.75 times less likely to die than children born to user mothers in the same age category.

Children of non-user mothers in the ages of 30 to 39 years at birth were at 0.82 times lower risk of death than children of user mothers aged 30–39 years. Thus, the overall results (Figure 2) indicate that children born to very young mothers aged 14–19 years who had used contraception at some stage were at the highest risk of dying. This suggests that young mothers are biologically and mentally not prepared to handle the birth and nurturing of infants. Amongst the non-users of contraception, children belonging to mothers in the middle age group, 20–29 years, had the highest risk of dying. This is perhaps the result of high parity attained at relatively young ages with closely spaced children in the absence of use of contraception.

Mother's Past and Current Residence

Children belonging to mothers who had spent their first 12 years of life in any other city or town (which may or may not be as developed in terms of health care provision) and had lived in the current place of residence for 10 years or less were 1.43 times more at risk of dying than children whose mothers had lived their early life in a city or town but had been at the present place of residence for a period of 11 to 25 years. Those children whose mothers had spent their first 12 years of life in a village had an even higher death risk ratio of 2.49 compared to the reference category. When the children of mothers of the city and village background who had lived in the study area for a maximum of 10 years are compared, the difference in the risk ratios shows that children of village mothers were at a higher risk of 1.75 than children of the city mothers. This suggests that children of the mothers who were brought up in a city were better off than those whose mothers spent their initial years of life in a village. It could be said that women who were brought up in a city and were recent settlers in the study area, perhaps had better health behaviour than the villagers but their awareness and knowledge level was certainly lower than that of women who had lived in the study area for a longer period.

Interestingly, children of mothers who had spent their early years of life in a village but had been living in the current place of residence from 11 to 25 years had a lower death risk ratio of 0.71 than children born to mothers who had spent their early life in a city and had lived in the study area for up to 25 years. Children of the former category were also 0.50 times at a lower risk of dying when compared with children of city mothers who had lived in the current place of residence for 10 years or less. The differences are large when the death ratios for children of mothers with a village background in the two given categories are compared. The death ratio was as high as 3.49 for children of relatively recent settlers who had come from the village compared to children of the initial village dwellers who had spent a longer period of 11 to 25 years in the current place of residence (Figure 3).

Overall, the results suggest that the place of current residence was more conducive to lowering the mortality of children under five years of age. Women who

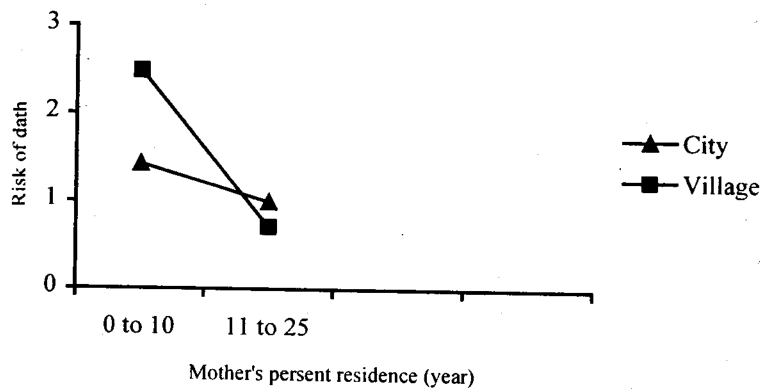

Fig. 3. Risk of Child Death by Mother's Past and Present Residence.

Source: Child Health Survey, Rawalpindi, 1992.

had been brought up in a city but had lived in the study area for a longer period were better off than other women who since childhood were city dwellers but had lived in the study area for a relatively shorter period. The case was worse for women who spent their childhood in a village and were recent settlers in the present place of residence. It appears that in both the cases the receptivity of these women towards the use of the available health care services, their knowledge and practices were marred by behaviour adverse to the health of the children. Yet these very women who had lived their first 12 years of life in a village but had lived in the present place of residence for a longer period became even better off than those who had spent all their lives in a city. This suggests that there was no dearth of health care services in the study area; that residents who had spent their early life in a city conformed to a mixture of traditional beliefs and practices with modern knowledge; and that village dwellers experienced higher child death rates but were more open to accepting new ideas and knowledge; the longer the exposure the greater was their receptivity. Their receptivity was even greater when compared to the exposure of women who had lived their initial life in a city and had lived in the study area for about an equal number of years. Thus, the availability and accessibility of the resources along with the facilities conducive to better health consciousness will affect the health behaviour of the mothers resulting in enhancement of their knowledge, attitude and behaviour related to better health.

Mother's Present Residence by Current Age

The interaction between the number of years lived in the study area and mother's age at the time of the survey suggests that children born to younger mothers aged 15–29 years who had lived almost all their lives in the study area were at lower risk of death than children of the mothers, younger or older, who had lived for more or fewer years in the study area. Children of older mothers aged 30–39 years who had lived in the area for 11 to 25 years had a higher death ratio of 3.91 than children of younger mothers who had lived in the area for about the same period. The children of women 15–29 years who had lived in the study area for ten years or less were 1.43 times at greater risk, and children of women aged 30–39 years who had lived in the study area for a shorter duration were at 1.77 times at greater risk than children of mothers included in the reference category: those aged 15–29 years who had lived in the study area for 11–25 years.

Comparing the death risks of the children of older mothers aged 30–39 years by the number of years lived in the area suggests that children born to mothers who had lived there longer were 2.21 times as likely to die as children of older mothers who had lived in the area for a period of up to 10 years. When the death risk ratios for children born to older mothers with a longer stay were compared with those born to younger mothers who had lived in the area for a shorter period of up to 10 years, it was found that children of mothers in the former category were still 2.74 times as likely to die as children belonging to younger mothers in the latter category. Comparisons between the risk ratios for children of younger and older mothers who had lived in the present place of residence for relatively short periods of up to 10 years reveal that children of older mothers were 1.24 times at a greater risk of death than children of younger mothers (Figure 4).

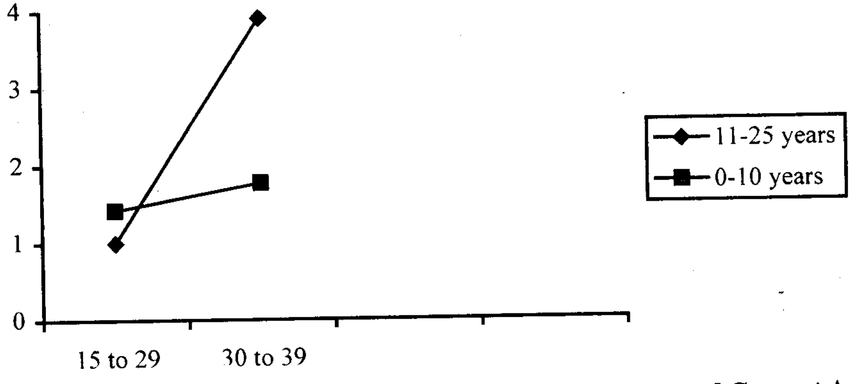

Fig. 4. Risk of Child Death by Mother's Present Residence and Current Age.

Source: Child Health Survey, Rawalpindi, 1992.

The overall findings suggest that regardless of the duration of stay at the current place of residence, older mothers experienced more child deaths than younger mothers, perhaps because older mothers had borne a greater number of children. Older women were less educated and were more likely to practise traditional health beliefs as well as using modern health facilities. However, it seems that many of the older women who had lived longer in the city were rather conventional and rigid in their attitude to new ideas, knowledge and behaviour. They were even worse off than older women who had lived in the study area for a shorter period but seemed more adaptable to the city environment and behaviour. Many relatively young mothers had spent a large part of their youth in the city environment and were probably likely to accept and practise modern health care and knowledge more efficiently.

Mother's Age and Parity

Of all the women included in the survey, the lowest risk of child death was amongst mothers aged 15 to 29 years who had borne a maximum of 1–3 children. As the figures in Figure 5 show, the death ratio for children of mothers in this age group increases progressively with the increase in the number of children borne, rising to 2.42 for 4 to 6 children ever born and 3.63 for children of mothers who had given birth to 7 to 11 children.

On the other hand, amongst women aged 30 to 39 years, children of mothers who had 4 to 6 children ever born had the lowest death ratio (1.53), with considerably higher ratio (3.91) for children of mothers who gave birth to 1–3 children and very high risk ratio (5.23) for children of mothers who had borne 7 to 11 children.

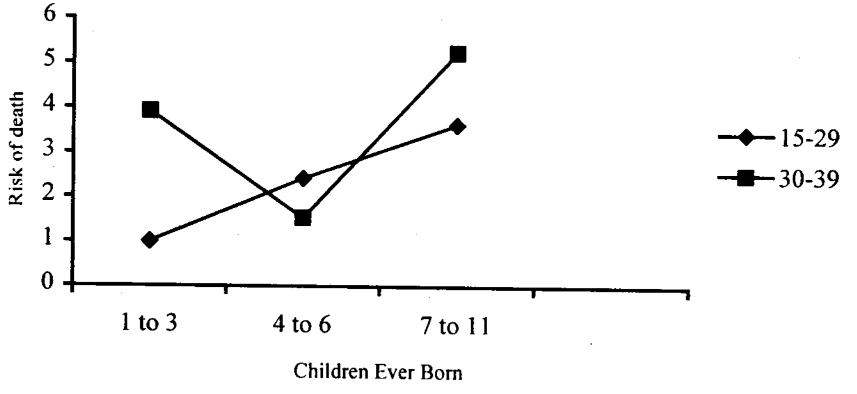

Fig. 5. Risk of Child Death by Mother's Age and Number of Children Ever Born.

Source: Child Health Survey, Rawalpindi, 1992.

Differences by the number of children ever born to mothers in the two age groups suggest that overall the highest risk of child death was amongst high-parity mothers. Children of older mothers in the age group 30–39 years were 1.44 times more likely to die than children of younger mothers of the same parity. Taking the category of 4–6 children ever born and comparing the death ratios by the age of the mothers, the death ratio was higher by 1.58 for children of younger mothers aged 15–29 years when compared with the risk ratio for children of older mothers (30–39 years) who had ever borne the same number of children. For some reason, children of older mothers remained at high risk even at low parity of 1–3 children. This probably means that these women started childbearing at a relatively late age and were bearing children at shorter intervals than the others. However, the overall finding suggests that the child death ratios were sporadically scattered within the pattern described above and confirms the earlier finding in the multivariate model which did not emerge with the usual pattern of higher risks to mothers in the younger and older age groups.

CONCLUSION

The analysis of the data, based on both statistical and observational methods, revealed that sustained high level of child mortality was related to high fertility and other related factors. This study showed that the most significant variable correlated with child survival was the number of children ever born. Increase in the number of children within the household led to a proportionate increase in child deaths. This did not mean that children of younger mothers were at lesser risk of death; in fact, the proportion of children who died had a logical association with the age of the mother and parity. Children in households with three or more children were at more than twice the risk of death than those in households with only 1-2 children. The death risk ratio further increased for children in households with 6–8 children and reached a high proportion for children living in households with a total of 9–11 children.

Demographic variables like the mother's age at birth, order of birth and birth interval between the proceeding and the succeeding child constitute some of the important associates of child mortality. Almost all studies conducted in Pakistan, except for the Pakistan Fertility Survey, indicate a 'U'-shaped relationship between birth order and infant mortality suggesting high death risk ratio for the first and higher birth orders. The pattern of mortality in relation to birth order is considered to be associated with the age of the mother, with higher risk of death at younger and older ages than in the middle age groups. Analysis for this study does not confirm this pattern, although 67 percent of the total 1,301 children included in the study were born to women married between the ages of 12–19 years, of whom about 58 percent were of first birth order: most of the first births to these women took place in their teens. It is possible that the birth order effects may have been compounded by period effect resulting in underestimation of the first birth order to younger mothers than higher birth order to older mothers occurring in the most recent period preceding the survey.

The findings in this study, on the other hand, show a strong independent correlation between children born after a short interval of one year and high death ratio, suggesting that children born after an interval greater than one year had a greater survival probability. However, after the effects of the other variables are controlled for, the effect of birth interval weakens. For example, the effect of birth interval becomes considerably weak on entering the variable 'use of family planning method in the past' and the effect was completely offset with the age of the mother. This did not mean that there was no statistically significant correlation between shorter birth interval and high risk of child death. In fact children born after a shorter birth interval remain at lower probability of survival and as the results show the effects of birth interval were largely associated with and depended on the use of family planning in the past and the age of the mother. Hence, children born to mothers who used family planning in the past had a greater probability of survival than children born to mothers who had never used family planning, suggesting that children belonging to the former were more likely to be born after a longer birth interval than the latter, thus having a greater probability of survival.

Older mothers were more likely to use contraception than the younger mothers and as a result recent children born to older mothers were at a lower risk of dying than children born to younger mothers. Children born to mothers in the age groups of 30–34 and 35–39 were 0.4418 and 0.2689 times less likely to die than children of younger mothers even though the children of the former categories were of higher birth orders. Thus, the lower risk of child death amongst children born to older mothers was not only associated with a longer birth interval, it also indicated that these children had the associated benefits of longer breastfeeding; lower risk of dying as a result of greater physical and biological recuperation of the mother; and reduced competition for available resources and mother's personal attention.

Culturally specified norms of early marriage and non-use of contraception favour larger family size. The only countervailing factor was the educational attainment of the mother. Mothers who went to school, especially those who attained higher education, spent their early phase of adult life in an educational institution which delayed their age at marriage. This is demonstrated by the data which indicate that most of the women married between 25 and 31 were those who had attained higher education. Adhering to the cultural ethos, all married women, either educated or not, would have the motive of having their first born right after the onset of marriage. Nonetheless, the data show that the use of contraception was more common amongst the educated. Most of them had 3–5 or fewer children and ten percent had 6–8 children. None of the mothers with higher education had as many as 9–11 children whereas 88 percent of the children in the category of 9–11 children ever born were born to women with no education. The greater survival of children belonging to educated mothers was more likely to be associated with the use of contraception which led to longer birth spacing. These mothers were also more likely to comprehend the overall advantages of the use of contraception other than in limiting family size. Because of better knowledge of the purposes involved, unlike some uneducated women who complained of becoming pregnant in spite of the use of contraception, these women were likely to use a family planning method correctly. The advantages of education are also reflected in the level of hygiene maintained in the household.

All the three variables included in the study to measure the household's hygienic environment were independently significantly associated with child mortality. However, the mode of garbage disposal, in combination with other significant variables had the strongest effect on the survival probabilities of children below the age of five years. When the household garbage was left exposed to the environment, it was a perfect breeding place for germ-carrying insects to transmit various infections. The contamination affected the young children and probably led to a higher death rate than in other households which maintained a covered garbage container. The respondents in households with an open garbage container perhaps lacked the vision to discern how the unhygienic environment could easily spread infection through contaminating food and water. Much depends on the perception of the mother, who is responsible for almost all household duties. Clearly, mothers took pains to clean the house and disposed of the garbage in the container. Had they a better knowledge of what made their children fatally ill, they would have perhaps taken one step further by resorting to a container with a lid.

The association between child mortality and the mode of garbage disposal provides a plausible explanation to the familial differences in the survival probabilities. Children who belonged to households with an open garbage container were 1.57 times more at risk of dying than those who were living in households with a covered garbage bin. This shows that unhygienic living conditions were the major source of infectious diseases from the household environment to which each member of the family was exposed. The most likely subgroup of the population readily susceptible to various communicable infections are the children, especially those in their first and second year of life whose immune system is not fully developed. Young children under five years of age would generally be more susceptible to infections especially in the case of undernutrition leading to weak health and as a result increasing the probability of contracting infections. Thus, if a child within the household contracted an infection from the environment, other children in the same household could be at the risk of contracting infections either directly through the source or through cross-infection. Almost all the childhood diseases considered in this study are contagious, and in such living conditions as found in the study area, like a large number of household members living in small congested houses, cross-infection amongst young children is conceivable.

Overall, this study provides strong evidence that the homes of the educated scored better than those of the uneducated. The results clearly indicate that variations in the socio-economic background were not the factors mainly responsible for the differentials in child health but that differences in attitudes and perceptions exert a powerful and an independent effect on the indices of health-seeking behaviour.

As a matter of national policy, the government of Pakistan needs to first, redress its population and health strategies for improving the quality and access to services. It needs to be realised that infant and child mortality in Pakistan has stalled at around 100 per 1000 live births: this is perhaps one of the major causes hindering the success of the family planning programme, as high child mortality leads to further increases in subsequent fertility owing to the underlying effects of the probabilities of child survival.

Secondly, in an attempt to bring about a demographic change, the government must take into account the social significance of female literacy and education (the lowest even when compared to the South-Asian countries) which, as this study suggests, is central to lowering fertility, mortality and morbidity and acts as an agent of change in every sphere of life.

Appendix

Appendix Table 1

Percent Distribution of Cohort of Children by Various Socio-economic Factors (N=1301)

Variables	Percent
Mother's Past Residence	
City/Town	56.2
Village	43.8
Mother's Present Residence	
0–10 Years	65.6
11–25 Years	34.4
Religion	
Muslim	71.5
Christian	28.5
Ethnicity	
Punjabi	87.6
Other	12.4
Mother's Education Status	
No Education	54.5
1–8 Years	27.5
9 or More	18.0
Father's Education Status	
No Education	35.4
1–8 Years	25.3
9 or More	39.3
Mother's Occupation	
Working	23.0
Not Working	77.0
Father's Occupation	
Government Service	63.9
Self-employed	34.7
Unemployed	1.4
Total Household Income	
Upto Rs 3,000	62.8
Upto Rs 4,000	22.4
Rs 4,000 or More	14.8
Total Persons in Household	
Less than 6	18.1
6 or More	81.9
Possession of Radio	
Yes	69.9
No	30.0
Possession of Television	
Yes	79.9
No	20.0
Possession of Refrigerator	
Yes	37.4
No	62.6

Source: Child Health Survey, Rawalpindi, 1992.

Appendix Table 2

Percent Distribution of Cohort of Children by Various Environmental and Hygienic Factors (N=1301)

Variables	Percent
Type of Toilet	
Flush	33.0
Without Flush	67.0
Type of Garbage Container	
Covered	41.2
Open	58.8
No. of Rooms in the House	
1 Room	35.6
2 or More	64.4

Source: Child Health Survey, Rawalpindi, 1992.

Appendix Table 3

Percent Distribution of Cohort of Children by Various Demographic Factors (N=1301)

Variables	Percent
Sex of Child	
Male	51.9
Female	48.1
Children Ever Born	
1–2	14.1
3–5	46.0
6–8	28.1
9–11	11.8
Birth Order of Child	
First Born	26.2
2–3	39.8
4–5	21.4
6–11	12.6
Length of Birth Interval (Months)	
12 Months	20.3
Between 12 to 24	31.9
Between 24 to 36	12.3
36+ or 1st Born	35.5
Mother's Age at Marriage	
12–19 Years	66.7
20–24 Years	27.1
25–31 Years	6.2
Mother's Current Age	
15–19 Years	1.5
20–24 Years	14.4
25–29 Years	27.7
30–34 Years	26.1
35–39 Years	30.3

Source: Child Health Survey, Rawalpindi, 1992.

Appendix Table 4

Percent Distribution of Cohort of Children by Family Planning in the Past (N=1301)

Variable	Percent
Contraceptive Use in Past	
Users	50.7
Non-users	49.3

Source: Child Health Survey, Rawalpindi, 1992.

Appendix Table 5

Percent Distribution of Children Born at Varying Birth Intervals by the Order of Birth (N=1301)

	Order of Birth			
Birth Intervals (Months)	Order 1	2–3	4–5	6 or More
12 Months		59.5	26.1	14.4
Between 12–24		53.3	28.4	18.3
Between 24–36		48.1	33.1	18.8
36+ or 1st Born	73.8	13.6	8.2	4.3

Source: Child Health Survey, Rawalpindi, 1992.

Appendix Table 6

Percent Distribution of Children Born at Varying Birth Intervals by the Number of Children Ever Born (N=1301)

	Number of Children Ever Born			
Birth Intervals (Months)	1–2	3–5	6–8	9 or More
12 Months	5.7	42	34.8	17.4
Between 12–24	6.5	45.1	30.8	17.6
Between 24–36	11.3	48.1	29.4	11.3
36+ or 1st Born	26.8	48.3	21.2	3.7

Source: Child Health Survey, Rawalpindi, 1992.

Appendix Table 7

Percent Distribution of Children Born at Varying Birth Intervals by the Educational Status of the Mother (N=1301)

	Order of Birth		
Birth Intervals (Months)	No Education	1–8	9 or More
12 Months	53.8	29.5	16.7
Between 12–24	58.8	26.5	14.7
Between 24–36	57.5	25.6	16.9
36+ or 1st Born	50.0	27.9	22.1

Source: Child Health Survey, Rawalpindi, 1992.

Appendix Table 8

Percent Distribution of Children of Varying Birth Orders by Mother's Age at Birth (N=1301)

Mother's Age at Birth (Years)	Order of Birth			
	Order 1	2–3	4–5	6 or More
12–24	84.2	64.7	31.3	4.9
24–36	15.8	35.3	68.7	95.1

Source: Child Health Survey, Rawalpindi, 1992.

Appendix Table 9

Percent Distribution of Children Ever Born by Mother's Education Status (N=1301)

Children Ever Born	Mother's Education (Years)		
	No Education	1–8	9 or More
1–2	35.3	26.1	38.6
3–5	47.3	31.8	20.9
6–8	61.6	27.9	10.4
9 or More	88.3	11.7	–

Source: Child Health Survey, Rawalpindi, 1992.

Appendix Table 10

Percent Distribution of Children by Past Family Planning and Mother's Educational Status (N=1301)

Family Planning	Mother's Education (Years)		
	No Education	1–8	9 or More
Users	40.1	61.5	66.7
Non-users	59.9	38.5	33.3

Source: Child Health Survey, Rawalpindi, 1992.

Appendix Table 11

Percent Distribution of Children by Mother's Age and Educational Status (N=1301)

Mother's Age (Years)	Mother's Education (Years)		
	No Education	1–8	9 or More
15–19	65.0	35.0	–
20–24	47.3	39.4	13.3
25–29	46.7	30.6	22.8
30–34	54.0	24.8	21.2
35–39	65.0	21.1	14.0

Source: Child Health Survey, Rawalpindi, 1992.

Appendix Table 12

Percent Distribution of Children by Mother's Age at Marriage and Educational Status (N=1301)

	Mother's Education (Years)		
Age at Marriage (Years)	No Education	1–8	9 or More
Less than 20	64.1	29.7	6.2
20–24	36.6	24.1	39.2
25–31	29.6	18.5	51.9

Source: Child Health Survey, Rawalpindi, 1992.

Appendix Table 13

Percent Distribution of Children by Mother's Age at Marriage and Mother's Current Age (N=1301)

Mother's Age at Birth (Years)	Mother's Age (Years)				
	15–19	20–24	25–29	30–34	35–39
Less than 20	2.3	17.6	26.3	24.7	29.1
20–24	–	9.9	35.5	27.6	27.0
25–31	–	–	8.6	34.6	56.8

Source: Child Health Survey, Rawalpindi, 1992.

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