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Demographic and Socioeconomic correlates of Neonatal, Post-neonatal and Childhood Mortality in Uttar Pradesh, India: A Study based on NFHS-2 data

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Abstract

Though the levels of infant and child mortality in India have been declining over the years, it is still considerably high among the north-central states. This paper, using data of National Health and Family Survey (NFHS-2), 1998-99, tries to find out the effects of various spatial, demographic and socio-economic factors on neonatal, post-neonatal and childhood mortality in the large state of Uttar Pradesh in north-central India. It also tries to re-examine the hypothesis that, endogenous (demographic or biological) factors are primarily responsible for neonatal mortality, whereas exogenous (socio-economic) factors contribute more in the post-neonatal and childhood period. The results of multivariate analyses broadly confirm the hypothesis, though maternal education and length of the preceding birth interval have profound positive effect on survival during all the period; neonatal, post-neonatal and childhood.

Key Words: Neonatal mortality, Post-neonatal mortality, Childhood mortality, Endogenous factors, Exogenous factors, Multivariate logistic regression, Proportional hazards model.

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Introduction

The level of infant and child survival of a population is one of the key indicators of the improvement of the quality of life. Although levels of infant and child mortality are falling, they are still considerably high in India, especially, in its underdeveloped north-central states. The data of National Family and Health Survey, 1998-99 (NFHS-2), reveals that about 69 in 1000 live births did not reach their first birthday.

Mosley and Chen (1984) identify five groups of proximate determinants of child health: factors related to the mother (age, parity, birth interval); environmental pollution; nutrient deficiency; injury; and personal illness control. It is posited that all these are influenced by socio-economic factors, which include (1) individual level variables (individual productivity, as measured by education and occupation; and traditions, norms, and attitudes); (2) house-hold level variables (income, wealth); and (3) community-level variables (ecological setting, political economy, health system).

This framework can be crystallized into the following three levels of variables, namely, (A) *Demographic variables* (factors biologically affecting child and mother such as age of mother, duration of breastfeeding, length of the preceding birth interval, sex of the child, occurrence of multiple birth and birth order etc). (B) *Socio-economic and environmental variables* (factors affecting mother and household associated with education, income, occupation, sanitation, supply of potable water, safe cooking fuel, type of house, crowding, separate room as kitchen etc.). (C) *Maternal and child health care variables* (factors affecting accessibility and utilization of maternal and child health services).

These categories stated above should not be treated as watertight compartments, for there is a great deal of interaction among them. It has generally been assumed that factors that affect fetal and neo-natal death are primarily endogenous (i.e. biological or demographic), while those which affect post-neonatal deaths are primarily exogenous (i.e. socioeconomic). Babies born to young mothers are more likely to be premature, have low birth weights, and suffer from complication at the time of delivery (Hobcraft et al., 1984, Pandey et al., 1998). It has been found that unadjusted neonatal mortality has a U-shaped relationship with birth order in India as a whole; but with the adjustment for other factors, neonatal mortality decreases linearly with increasing birth order (Pandey et al., 1998). But study in Bangladesh shows that infant and child mortality increases as birth order increases (Howlader et al., 2000). Longer birth interval between two births significantly enhances the chances of infant and child survival and the relationship among lactation, birth interval, fertility and child mortality varies not only from country to country but also from one segment of population to another segment within the same country (Hobcraft et al., 1983, 1984, Luntz et al., 1992, Miller et al., 1992, Pandey et al., 1998). The excess female mortality at post-neonatal and childhood period has been observed in India and other South Asian countries and it is believed to be due to son-preference that leads to differential treatment of son and daughter in terms of food allocation, healthcare and treatment of illness (Gupta, 1986; Visaria, 1987; Reddy et al., 1989; Arnold et al., 1998; Pandey et al., 1998).

Social, cultural, economic and environmental factors are also found to affect infant and child mortality, especially, during the post-neonatal period. Caldwell (1979) argued that maternal education of women plays an important role in determining child survival even after controlling for a number of socio-economic factors. Several other studies also established the influence of maternal education on infant and child mortality (Cochrane and others, 1980; United Nations, 1985, 1984; Da Vanzo and Habicht, 1986; Cleland and Van Ginneken, 1989; Bicego and Boerma, 1993). Some studies have found that there is a strong income effect on infant and child mortality even after controlling other socioeconomic factors (Defo, 1994; Pandey, 1998). Researches in India and other cross-national studies in developing countries suggested that there is negative relationship between maternal work and infant and child survival (Hobcraft et al., 1984; United Nations, 1985; Zachariah, 1994; Basu and Basu, 1991; Sivakami, 1997; Pandey et al., 1998; Kishor and Parasuraman, 1998). Also some studies revealed that mother's exposure to electronic mass media significantly lowers fertility and infant mortality even after controlling other socioeconomic variables (Gandotra et al., 1998; Rao et al, 1998). Some micro-level studies in India have

shown that there is also religion and caste differential in the use of maternal and child healthcare and related traditional practices which affect infant and child mortality (Singh, 1989; Mahadevan et al., 1986, Pandey et al., 1998).

The present article attempts to identify the demographic and socioeconomic covariates that affect infant and child mortality with data from Uttar Pradesh, a very large state in north-central India, where the infant and child mortality rate is very high, the level of fertility is also high and the level of social development is low. It also tries to re-examine the hypothesis that primarily endogamous factors affect neonatal mortality whereas exogenous factors play relatively more important role in influencing post-neonatal and childhood mortality.

Data and Methods

Data for this study are drawn from the National Family Health Survey-2, Uttar Pradesh, which was carried out between 4 December 1998 to 20 March 1999 by Population Research Center (PRC), Lucknow and the International Institute for Population Sciences (IIPS), Mumbai. For the purpose of data collection, Uttar Pradesh was divided into five zones, namely, Hill, Western, Central, Eastern and Bundelkhand (for definition see table 1). The survey collected information from 8,682 households and interviewed 9,292 ever-married women (in the age group 15-49) on fertility, mortality, family planning, and important aspects of reproductive health, nutrition and childcare.

Information on all the live births a women had (fertility history) was obtained and for each birth, the month and year of birth, type of birth (single or multiple), mother's age at child birth, survival status at survey, and in case of death, age at death were recorded. However, due to the problem of 'recall lapse', data especially on births in the distant past would be of poor quality. An assessment of birth history data suggests that quality of information 15 years preceding the survey is reasonably good for detailed analysis of infant and child mortality (Brass and Rashad, 1980). Keeping this in mind the analysis was restricted to births that occurred after 1 January, 1984, that during the 15-years period before the survey and a child based data file consists of 22,909 live births has been created from individual file of women. Detailed information on maternal and child healthcare, breast-feeding, birth weight etc. was available only for the last two births that have taken place during the last three years. So this study had to exclude these variables from the analyses. Though it is regarded that these covariates have a significant impact on infant and child mortality and exclusion of these variables may influence the estimates of the effects of demographic and socioeconomic covariates on mortality.

The following variables are used in the study: based on information on the survival status of the child at the time of survey and age at death (months-imputed), deaths are classified into three categories: neonatal deaths (death occurring before completion of the first month of life), deaths at post-neonatal ages (death occurring after the completion of the first month but before completion of the first year of life) and childhood deaths (death occurring after the completion of the first year but before completion of the five years of life).

The predictor variables influencing mortality at the neonatal, post-neonatal and later childhood ages are grouped into the following categories: the demographic and biological variables included are mother's age at child birth, occurrence of multiple births, birth order, sex of the child and length of the preceding birth interval. The socioeconomic variables included are maternal education, standard of living, work status of mother, religion, caste (ethnicity), exposure to mass media and crowding in the households. Caste system is an age-old phenomenon of Indian social system. Within the caste hierarchy, some groups are the most disadvantaged, traditionally oppressed and treated as untouchable by the upper castes; these have been classified as scheduled castes and scheduled tribes by government notification. Also being a multi-religious country, a great variation in the socio-cultural practices has observed among various religious groups like Hindu, Muslims, Christians, and Sikhs etc. The variable 'exposure to mass media' has been created from three separate variables, namely, 'read newspaper or magazine at least once a week', 'watch television at least once a week' and 'listen to radio at least once a week'. These three variables are found to be strongly associated with each other and so a composite variable has been

obtained from these three: 'exposure to mass media of any sort'. If a woman is exposed to any of these three, then she is regarded as exposed to any sort of mass media. Here 'crowding' variable is created from two separate variables, namely, 'total number of rooms in household' and 'number of household members' i.e. crowding represents here the average number of persons in a room. Further it has been grouped into two categories: less than or equal to 3 persons per room and greater than 3 persons per room. As the household income is not directly available, standard of living index (calculated by NFHS-2) has taken as the proxy for household economic status. Standard of living index consist of the following household and economic characteristics. This includes type of house, toilet facility, source of lightning, main fuel for cooking, source of drinking water, separate room for cooking, ownership of house, ownership of agricultural land, ownership of irrigated land, ownership of livestock and ownership of durable goods.[1]

As neonatal, infant and childhood mortality varies across space, another two spatial variables, namely, type of residence (rural/urban) and region of residence have been included in the study as control variables. In Uttar Pradesh, Hilly (now separated as the State of Uttaranchal) and Western regions are relatively developed in terms of female literacy, living standard, economic infrastructure, industry and agriculture than other parts of the state. Whereas, Bundelkhand and Eastern regions are termed as backward region due to their geographic terrain, low female education, traditional patriarchal family system and highly oppressive caste system.

Mortality in the neonatal period is studied using four separate sets of logistic regression model. Since our objective is to see the effect of demographic and socioeconomic variables on neonatal, infant and childhood mortality and to re-examine the hypothesis on the effect of endogenous and exogenous factors on neonatal, post-neonatal and childhood period, the following four sets of generalized equations have been developed:

$$\text{Logit } q = \beta_0 + \sum\beta_{1i} X_{1i} + \sum\beta_{2i} X_{2i} \quad \text{----------(Eqn 1)}$$

$$\text{Logit } q = \beta_0 + \sum\beta_{1i} X_{1i} + \sum\beta_{2i} X_{2i} + \beta_3 X_3 \quad \text{----------(Eqn 2)}$$

$$\text{Logit } q = \beta_0 + \sum\beta_{1i} X_{1i} + \sum\beta_{2i} X_{2i} + \sum\beta_{4i} X_{4i} \quad \text{----------(Eqn 3)}$$

$$\text{Logit } q = \beta_0 + \sum\beta_{1i} X_{1i} + \sum\beta_{2i} X_{2i} + \beta_3 X_3 + \sum\beta_{4i} X_{4i} \quad \text{----------(Eqn 4)}$$

Where, q is the probability of dying; logit q=ln (q/1-q); and $\{X_{1i}\}$ are demographic variables, $\{X_{2i}\}$ are spatial variables, X_3 is the length of the preceding birth interval, and $\{X_{4i}\}$ are socio-economic variables.
Here equation 1 includes the demographic (X_{1i}) and spatial variables (X_{2i}) and all live births are considered here, whereas equation 2 includes all the variables of equation 1and preceding birth interval (X_3) but only the second and higher order births are taken into consideration in this case. Since the variable preceding birth interval is not relevant to births of first orders, equation 3 includes socioeconomic variables (X_{4i}) and the demographic and spatial variables of equation 1 and all live births have been considered here. Equation 4 includes socioeconomic variables (X_{4i}) and the variables of equation 2 but only second and higher order births are taken into consideration in this case. The results of logistic regressions of the above four equations are transformed into simple cross-tabulation of probability of neonatal mortality using multiple classification analysis (Retherford and Choe, 1993). This involves calculating unadjusted and adjusted values of the response variable for each category of predictor variable.

To study mortality in the post-neonatal and later childhood period, proportional hazards model analysis (Cox, 1972) has been carried out with a set of similar equations described above.
The general form of the hazard model is expressed as

$$h(t,X) = h_0(t)e^{\Sigma\beta ixi} \quad \text{---------- (Eqn 5)}$$

[1] For details of score please refer to the report of National Health and Family Survey, Uttar Pradesh, 1998-1999.

Where h_0 denotes the baseline hazard function, which refers to the experience to the mortality;
and the vector X (x_1, x_2, ….) denotes the set of predictor variables and β_i are the coefficients of these variables. An important assumption, implicit in the structure of the equation, is that the hazards at time t is modified by the characteristics of a unit (x_1, x_2, ……) with $e^{\Sigma\beta ixi}$ as multiplier and this multiplier does not vary over time, hence the term 'proportional' hazards. The results of hazards model analysis are given in conventional format of regression coefficients. The predictor variables may be continuous or in a categorical form. In the later case, one category is designated as 'reference category'. The coefficients for the other categories then give the effects on hazards relative to that of the reference category.

Results and Discussion

Univariate Distribution of Major Variables

Table 1 shows the definitions and percentage distributions of the response variables and predictor variables separately for the analysis of 'all live births' and 'second and higher order live births'. In the state of Uttar Pradesh as a whole, about 94 per cent children are alive at the end of the first month of life. It decreases to 92 per cent after post-neonatal period and child survival increases after completion first year of life. It has been found that more than half of the children belong to the mothers of age group 20-29. As expected, proportion of second and higher order births is substantially less among the teenage mothers and high among the mothers of 30 and above. Being large in area, Western and Eastern region of the state have a large proportion of children in the total sample drawn in the state, whereas, Hilly and Bundelkhand regions consist of very small sample (actually these regions comprised only a small number of districts). Births of order 4 and above children are found to be highest and first birth order children represent least in the sample. It has been observed that about 83 per cent of children belong to rural areas, more that 53 per cent of children born after 24-48 months of previous birth. More than half of the children belong to the households having medium standard of living followed by lower standard of living (about 34 per cent). It has been seen that more than three-fourths of mothers are illiterate, whereas about two-third of mothers were not working at the time of survey. We have also observed that about 52 per cent of children belong to the crowded households, more than three-fourths of children are from Hindu community; about half of them are from non-scheduled non-other backward caste section of population. It has also been found that more than half of the mothers are not exposed to any kind of mass media.

Neonatal Mortality

Appendix Table 1 & 2 represents estimation results from logistic regression analyses for the neonatal mortality model for all births. The discussion here focuses on the adjusted results (predicted probabilities) given in Table 2. It has been observed from equation 1 among the demographic variables age of the mother, occurrence of multiple births and birth order have substantial effect on neonatal mortality and both the spatial variables region of residence and place of residence have also substantial effect on neonatal mortality. For equation 3, when all the demographic, spatial and socioeconomic variables are controlled, except place of residence, other variables stated just above and maternal education and crowding have significant impact on neonatal mortality. The probability of neonatal mortality is very high for the mothers of age below 20 years compared to those above 20 years. This supports the earlier findings that chances of neonatal mortality are always higher for teenage mother due to complication in pregnancy and delivery, premature birth and other related causes. The occurrence of multiple births has decisive negative impact on neonatal survival even after controlling all other socioeconomic variables and the multiple born neonates have more than 7.5 times the odds of dying than those born single (Appendix Table 1). Again the relationship between birth order and neonatal mortality is found to have a U-shape form: mortality is high for first born children and among the births of higher orders and substantially low for births of order 2 and 3. This supports the earlier findings that first order births are more likely to have a difficult process than later births that increases the risk of mortality and the births of very high order may have mothers who are physically depleted at the time of conception and

are likely to suffer from fetal growth retardation and low birth weight. This relationship does persist even after controlling the other socioeconomic variables. It has been observed that the children of hilly and western regions have substantially lower neonatal mortality chances than other regions even after controlling other socioeconomic variables. Though rural/urban differential in neonatal mortality was significant without controlling the socioeconomic variables, it disappeared after controlling the other variables. Among socioeconomic variables, only maternal education has substantial positive effect on neonatal survival. The chances of neonatal mortality decrease substantially and significantly as maternal education increases (it comes down from 0.063 for illiterate to 0.034 for higher educated per 1,000 live births). This finding reiterates the earlier finding that maternal education plays a very important role in child survival. Surprisingly it has been seen that neonates of the crowded household are less susceptible to the risk of mortality. This result is possibly due to reverse causation. Actually, at the time of survey the child has already died and as a result the number of household members decreased. So the result shows that the mortality is higher for those households, which have less number of inhabitants.

Though neonatal mortality is higher for the male children than female, for the children of working women than non-working, for non-scheduled non-other backward caste than other general castes, for Hindu children than Muslim and others and for those whose mothers, who are not exposed to mass media, none of these effects are statistically significant.

Table 3 presents computed predicted probabilities (adjusted values) of neonatal mortality for second and higher birth order (equation 2 & 4) for various categories. The logistic regression results are presented in Appendix Tables 3 & 4. The results are more or less similar, as we have seen for all births. Here the only addition is the adjusted effect of birth interval on neonatal mortality. It has been observed that, as the length of preceding birth interval increases, the probability of neonatal mortality decreases substantially. The effect persists and is highly significant even after controlling the other socioeconomic variables. This reiterates the fact that short cycle of pregnancy leads to progressively higher risk of low birth weight babies who have lower chances in the early phase of life.

Mortality during Post-neonatal Period

The results of hazards model analysis for all births showing the effect of demographic and spatial factors on post-neonatal mortality are presented in Table 4. The variables like mother's age at the time of childbirth, occurrence of multiple births; birth order (4 and above), region and place of residence continue to show significant association with post-neonatal mortality. In addition, sex of the child also shows moderate significant association with post-neonatal mortality and relative hazards of female mortality increases. The effect of birth order is U-shaped as seen in the case of neonatal period. The relative risk of dying decreases substantially for second and third birth order but increases later. After controlling the socioeconomic covariates, the effect of place of residence, birth order and sex differential in mortality decreases but maternal education, especially the higher education, and crowding show very significant positive association with post-neonatal survival (Table 5). Maternal work has been found to be relatively detrimental for infant's health and relative hazard in post-neonatal mortality is 1.2 times for the infant's of working mothers than their non-working counterparts. This result is in agreement with the earlier findings that maternal work has negative impact on child survival in the third world context. Interestingly, the effect of

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Table 1: Descriptions and Percentage Distribution of Variables in the Analysis of Neonatal, Post-neonatal and Childhood Mortality for Live Births, Uttar Pradesh, India, 1998-99.

Variables	Description	All Births	Second and Higher Order Births
Response Variables		Percent of Births	
Neonatal	Whether the child alive at the end of the first month of life	93.6	94.0
Post-neonatal	Whether the child alive after first month survives till the end of first year of life	92.2	91.8
Childhood	Whether the child alive at the end of first year survives till the end of five years of life	95.5	95.1
Predictor Variables	**Categories**	**Percentage Distribution**	
Demographic Variables			
Mother's Age			
<20	Mother's age is less than 20 years	23.8	12.4
20-29	Mother's age is in between 20-29 years	54.4	60.2
30+	Mother's age is equal or greater than 30 years	21.7	27.4
Multiple Births			
No	Child born single	98.5	98.2
Yes	Child born either first multiple or second multiple or so on.	1.5	1.8
Birth Order			
1	Child's birth order is 1	21.5	--
2-3	Child's birth order is 2 or 3	37.3	47.4
4+	Child's birth order is 4 or above	41.3	52.6
Sex			
Male	Child is a boy	52.2	51.9
Female	Child is a girl	47.8	48.1
Birth Interval			
<24 months	Child born after a gap of less than 24 months of previous child	--	34.6
24-48 months	Child born after a gap of 24-48 months of previous child	--	53.3
>48 months	Child born after a gap of more than 48 months of previous child	--	12.1
Spatial Variables			
Region			
Bundelkhand	Southern part of Uttar Pradesh	9.6	9.6
Hill	Northern hilly area of Uttar Pradesh	8.0	7.6
West	Western part of Uttar Pradesh	33.2	33.4
Central	Central part of Uttar Pradesh	14.8	14.7
East	Eastern part of Uttar Pradesh	34.4	34.7
Place of Residence			
Rural	Household situated in the rural area	82.5	82.9
Urban	Household situated in the urban area	17.5	17.1

Table 1 (contd.)

(contd.)

Predictor Variables	Categories	Percentage Distribution	
Socioeconomic Variables			
Standard of Living			
Low	Household having lower standard of living as per ownership of household goods (calculated by NFHS-2)	33.7	34.8
Medium	Household having medium standard of living as per ownership of household goods (calculated by NFHS-2)	53.0	53.1
High	Household having higher standard of living as per ownership of household goods (calculated by NFHS-2)	13.3	12.1
Maternal Education			
Illiterate	Mother is illiterate	76.2	78.8
Middle School Complete	Mother is literate with middle school complete	16.5	15.6
Higher Educated	Mother is literate with more than middle school or higher education	7.3	5.6
Mother's Work Status			
Not Working	Mother was not working except regular household activities at the time of survey	74.4	72.9
Working	Mother was working other than regular household activities at the time of survey	25.6	27.1
Crowding			
No	Child lives in a household with ≤3 persons/room	48.6	47.0
Yes	Child lives in a household with >3 persons/room	51.4	53.0
Religion			
Hindu	Child lives in a household whose head is Hindu	81.7	81.0
Muslim	Child lives in a household whose head is Muslim	17.4	18.2
Others	Child lives in a household whose head is other than Hindu or Muslim	0.9	0.8
Ethnicity			
Scheduled Caste & Scheduled Tribe	Child lives in a household whose head belongs to a scheduled caste or scheduled tribe	23.8	24.3
Other Backward Caste	Child lives in a household whose head belongs belongs to other State-specified backward caste	28.8	29.1
Others	Child lives in a household whose head is Non- Scheduled non- other backward caste as specified by the State	47.4	46.7
Exposure to Mass Media			
No	Mother does not watches television or listen to radio or read newspaper once a week	61.3	63.2
Yes	Mother watches television or listen to radio or read newspaper once a week	38.7	36.8
Number of Live Births	Number of children included in the analysis	22909	17991

Table: 2 Unadjusted and Adjusted Differentials in Neonatal Mortality by Demographic, Spatial and Socioeconomic Variables for All Live Births, Uttar Pradesh, India, NFHS-2, 1998-99

		Neonatal Mortality per 1,000 Live Births		
Predictor Variable	**N**	**Unadjusted**	**Adjusted****	**Adjusted*****
All Children	22909	.064	(Eqn.1)	(Eqn.3)
Mother's Age				
<20 (rc)	5463	.090	.088	.083
20-29	12470	.053	.050*	.051*
30+	4976	.064	.052*	.053*
Multiple Births				
No (rc)	22557	.060	.058	.056
Yes	352	.312	.310*	.314*
Birth Order				
1(rc)	4918	.080	.061	.065
2-3	8536	.052	.048*	.049*
4+	9455	.066	.067	.063
Sex				
Male (rc)	11963	.065	.060	.059
Female	10946	.063	.057	.057
Region				
Bundelkhand (rc)	2201	.074	.069	.066
Hill	1841	.037	.034*	.033*
West	7598	.055	.052*	.054
Central	3394	.077	.071	.072
East	7875	.071	.064	.061
Place of Residence				
Rural (rc)	18901	.068	.061	.059
Urban	4008	.045	.044*	.053
Standard of Living				
Low (rc)	7524	.070	--	.941
Medium	11822	.066	--	.059
High	2968	.045	--	.052
Maternal Education				
Illiterate (rc)	17451	.070	--	.063
Middle School Complete	3787	.053	--	.050*
Higher Educated	1671	.031	--	.034*
Mother's Work Status				
Not Working (rc)	17046	.061	--	.056
Working	5851	.073	--	.062
Crowding				
No (rc)	11134	.072	--	.067
Yes	11775	.056	--	.050*
Religion				
Hindu (rc)	18718	.067	--	.059
Muslim	3992	.052	--	.051
Others	199	.055	--	.056
Ethnicity				
Scheduled Caste / Tribe	5167	.076	--	.057
Other Backward Caste	6255	.055	--	.055
Others (rc)	10287	.069	--	.062
Exposure to Mass Media				
No (rc)	14050	.069	--	.059
Yes	8859	.056	--	.056

Table: 3 Unadjusted and Adjusted Differentials in Neonatal Mortality by Demographic, Spatial and Socioeconomic Variables for Second and Higher Order Live Births, Uttar Pradesh, India, NFHS-2, 1998-99

		Neonatal Mortality per 1,000 Live Births		
Predictor Variable	**N**	**Unadjusted**	**Adjusted****	**Adjusted*****
All Children	17991	.060	(Eqn. 2)	(Eqn. 4)
Mother's Age				
<20 (rc)	2236	.088	.067	.060
20-29	10833	.052	.045*	.044*
30+	4922	.064	.056	.055
Multiple Births				
No (rc)	17663	.055	.048	.050
Yes	328	.311	.286*	.302*
Birth Order				
2 (rc)	4608	.058	.048	.047
3	3928	.045	.041	.038
4+	9455	.066	.056	.049
Sex				
Male (rc)	9344	.060	.051	.049
Female	8647	.059	.049	.048
Preceding Birth Interval				
<24 Months (rc)	6221	.090	.083	.082
25-48 Months	9572	.047	.043*	.042*
>48 Months	2174	.024	.021*	.020*
Region				
Bundelkhand (rc)	1734	.067	.059	.054
Hill	1371	.028	.027*	.026*
West	6010	.051	.043*	.044
Central	2641	.072	.063	.062
East	6235	.068	.058	.054
Place of Residence				
Rural (rc)	14922	.063	.053	.049
Urban	3069	.043	.038*	.045
Standard of Living				
Low (rc)	6096	.065	--	.049
Medium	9297	.062	--	.049
High	2122	.042	--	.043
Maternal Education				
Illiterate (rc)	14185	.065	--	.052
Middle School Completed	2799	.048	--	.043
Higher Educated	1007	.024	--	.026*
Mother's Work Status				
Not-Working (rc)	13111	.056	--	.047
Working	4869	.071	--	.053
Crowding				
No (rc)	8449	.068	--	.057
Yes	9542	.053	--	.042*
Religion				
Hindu (rc)	14575	.062	--	.050
Muslim	3277	.049	--	.042
Others	139	.058	--	.045

Table 3 (contd.)

(contd.)

Predictor Variable	N	Neonatal Mortality per 1000 Live Births Unadjusted	Adjusted** (Eqn. 2)	Adjusted*** (Eqn. 4)
Ethnicity				
Scheduled Caste & Scheduled Tribe	4131	.072	--	.053
Other Backward Castes	4951	.050	--	.051
Others (rc)	7953	.062	--	.051
Exposure to Mass Media				
No (rc)	11364	.065	--	.050
Yes	6627	.051	--	.046

Notes on Table 2 & 3:

Adjusted values are estimated by logistic regression. Adjusted values are based on two sets of logistic regressions that include only the demographic variables in the first and both demographic and socioeconomic variables in the second. For any given covariate in the adjusted column, the set of control variables consists of all the other covariates, which are set at the mean values.

(rc) Reference Category.

*The coefficient in the underlying logistic regression differs significantly from zero at the 5 per cent level.

**Only demographic variables have been included in the analysis.

*** Both demographic and socioeconomic variables have been included in the analysis.

All the predictor variables discussed above have an adjusted effect that is statistically significant.

Table 4: Relative Risk of Post-neonatal Mortality for All Live Births: Hazard Regression Model Using Only Demographic and Spatial Variables

Predictor Variables	Coeff.	S.E.	Sig	Odd Ratio
Mother's Age				
<20 (rc)				
20-29	-.424	.101	.000	.654
30+	-.449	.135	.001	.638
Multiple Births				
No (rc)				
Yes	1.247	.190	.000	3.481
Birth Order				
1 (rc)				
2-3	.067	.106	.529	1.069
4+	.345	.125	.006	1.412
Sex				
Male (rc)				
Female	.171	.071	.015	1.187
Region				
Bundelkhand (rc)				
Hill	-.716	.185	.000	.489
West	-.421	.118	.000	.656
Central	-.026	.127	.836	.974
East	-.341	.116	.003	.711
Place of Residence				
Rural (rc)				
Urban	-.382	.107	.000	.682
-2LL		**15897.508**		
Total Sample		**21368**		

Note: (rc): Reference Category

Table 5: Relative Risk of Post-neonatal Mortality for All Live Births: Hazard Regression Model Using Demographic, Spatial and Socioeconomic Variables

Predictor Variables	Coeff.	S.E.	Sig	Odd Ratio
Mother's Age				
<20 (rc)				
20-29	-.309	.108	.004	.734
30+	-.326	.143	.023	.722
Multiple Births				
No (rc)				
Yes	1.321	.201	.000	3.747
Birth Order				
1 (rc)				
2-3	.011	.114	.923	1.011
4+	.206	.135	.127	1.228
Sex				
Male (rc)				
Female	.140	.074	.059	1.150
Region				
Bundelkhand (rc)				
Hill	-.649	.211	.002	.523
West	-.272	.135	.043	.762
Central	.068	.142	.634	1.070
East	-.264	.126	.036	.768
Place of Residence				
Rural (rc)				
Urban	-.112	.121	.354	.894
Standard of Living				
Low (rc)				
Medium	-.088	.084	.297	.916
High	-.266	.165	.106	.766
Maternal Education				
Illiterate (rc)				
Middle School complete	-.296	.119	.013	.744
Higher Educated	-.949	.256	.000	.387
Mother's Work Status				
Not Working (rc)				
Working	.187	.085	.028	1.206
Crowding				
No (rc)				
Yes	-.209	.078	.008	1.150
Religion				
Hindu (rc)				
Muslim	.022	.111	.839	1.023
Others	-.660	.580	.255	.517
Ethnicity				
Scheduled Caste / Tribe	.203	.100	.042	1.225
Other Backward Caste	.114	.095	.228	1.121
Others (rc)				
Exposure to Mass Media				
No (rc)				
Yes	.093	.088	.294	1.097
-2LL			**14346.388**	
Total Sample			**19678**	

Note: (rc): Reference Category

Living standard has not been observed to be significant after controlling all the demographic, spatial and socioeconomic covariates in the post-neonatal period. Though the effect of the occurrence of multiple births shows significant negative relationship with post-neonatal survival even after controlling the socioeconomic variables, the effect decreased substantially from that of neonatal period. This implies that as the child crossed the first month of life the risk of mortality from this biological cause declines to a larger extent. As in the case of neonatal mortality the relative hazards of post-neonatal mortality are also less for the children of Hill, Western and Eastern region of Uttar Pradesh when only the demographic variables are controlled, but the effect decreases considerably after controlling the socioeconomic variables. Higher maternal education found to be important, revealing that the relative hazard of post-neonatal mortality decreases to .4 times compare to illiterate women. Crowding also shows significant positive relationship with child survival as we have found in the neonatal period. And the same explanation of reciprocal causation that has been mentioned earlier is applicable in this case also. Other socioeconomic variables such as religion, caste and exposure to mass media show no significant relationship with post-neonatal mortality.

Tables 6 & 7 present the results of the relative risk of post-neonatal mortality for second and higher birth orders. This analysis includes the length of the preceding birth interval as an additional explanatory variable. The results are somewhat similar to those observed for all live births. The only exception is that the effect of mother's age at childbirth is no longer remains significant. It has been observed that higher birth order infants have significantly greater chance of mortality, when only the spatial and demographic covariates are controlled, but the effect declines somewhat when other socioeconomic variables are added in the equation. The effect of place of residence has been significant when only demographic and spatial predictor variables are considered in the equation and urban infants are having 0.7 times the hazards of mortality than their rural counterparts. But this is insignificant when socioeconomic variables are included in the equation (see Table 7) and hence the rural-urban differences observed earlier were probably on account of socioeconomic factors than residence *per se*. The effect of preceding birth interval continued to be very significant in the relative risk of post-neonatal mortality, even after controlling all other predictor variables. It has been found that child born after an interval of 24-48 months of previous child has about 0.5 times the risk of mortality than those born within 24 months of previous birth. Risk decreases further as the length of preceding birth interval increases. All other demographic, socioeconomic and spatial variables are found to have more or less similar impact on post-neonatal mortality for second and higher birth order children.

Mortality in the Later Childhood Ages

The results of hazards model analysis for all births showing the effect of demographic and spatial factors on the one hand and the demographic, spatial and socioeconomic factors on the other on childhood mortality are presented in Tables 8 and 9 respectively. The results are fairly similar to those observed in the case of post-neonatal mortality; the only exception is that the significant effect of standard of living has been observed in this case. On the other hand the effect of multiple births has completely been disappeared. The variables like mother's age at the time of childbirth; birth order, region and place of residence continue to show significant association with childhood mortality. In addition, sex of the child, which shows moderate significant association with post-neonatal mortality, has become highly significant now and relative hazards of mortality is quite high for girls compared to boys, even after controlling all other socioeconomic variables; the relative risk of mortality of female children is 1.7 times that of male children. This finding again re-establishes the evidence of son preference in this underdeveloped north Indian state and possibly discrimination in food allocation, prevention of diseases and accidents, and treatment of illness. A little change in the effect of birth order has also been observed. In this case, the relative hazards of childhood mortality are significantly high for higher order births. This is true even after controlling all other socioeconomic variables. A plausible reason could be that children of higher order births receive poorer food and care by virtue of being born in large families.

Table 6: Relative Risk of Post-Neonatal Mortality for Second and Higher Order Live Births: Hazard Regression Model Using Only Demographic and Spatial Variables

Predictor Variables	Coeff.	S.E.	Sig	Odd Ratio
Mother's Age				
<20 (rc)				
20-29	-.202	.133	.128	.817
30+	-.082	.162	.614	.922
Multiple Births				
No (rc)				
Yes	1.206	.209	.000	3.341
Birth Order				
2 (rc)				
3	.377	.127	.003	1.457
4+	.356	.126	.005	1.427
Sex				
Male (rc)				
Female	.227	.080	.004	1.255
Birth Interval				
<24 Months (rc)				
24-48 Months	-.632	.083	.000	.532
>48 Months	-1.153	.176	.000	.316
Region				
Bundelkhand (rc)				
Hill	-.542	.204	.008	.581
West	-.410	.134	.002	.663
Central	.044	.144	.760	1.045
East	-.354	.133	.007	.702
Place of Residence				
Rural (rc)				
Urban	-.378	.120	.002	.685
-2LL			**12119.202**	
Total Sample			**16841**	

Note: (rc): Reference Category

Table 7: Relative Risk of Post-Neonatal Mortality for Second and Higher Order Live Births: Hazard Regression Model Using Demographic, Spatial and Socioeconomic Variables

Predictor Variables	Coeff.	S.E.	Sig	Odd Ratio
Mother's Age				
<20(rc)				
20-29	-.052	.142	.712	.949
30+	.080	.172	.641	1.084
Multiple Births				
No (rc)				
Yes	1.270	.224	.000	3.561
Birth Order				
2 (rc)				
3	.286	.134	.033	1.331
4+	.224	.133	.093	1.251
Sex				
Male (rc)				
Female	.207	.083	.013	1.230

Table 7 (contd.)

(contd.)

Predictor Variables	**Coeff.**	**S.E.**	**Sig**	**Odd Ratio**
Birth Interval				
<24 Months (rc)				
24-48 Months	-.661	.087	.000	.516
>48 Months	-1.159	.181	.000	.314
Region				
Bundelkhand (rc)				
Hill	-.450	.233	.053	.637
West	-.194	.153	.205	.823
Central	.213	.161	.185	1.237
East	-.235	.145	.106	.791
Place of Residence				
Rural (rc)				
Urban	-.110	.135	.415	.896
Standard of Living				
Low (rc)				
Medium	-.063	.095	.509	.939
High	-.289	.189	.126	.749
Maternal Education				
Illiterate (rc)				
Middle School complete	-.212	.135	.116	.809
Higher Educated	-1.203	.357	.001	.300
Mother's Work Status				
Not Working (rc)				
Working	.200	.095	.034	1.222
Crowding				
No (rc)				
Yes	-.244	.088	.006	.784
Religion				
Hindu (rc)				
Muslim	-.095	.126	.450	.909
Others	-.946	.711	.183	.388
Ethnicity				
Scheduled Caste / Tribe	.217	.112	.053	1.242
Other Backward Caste	.129	.107	.226	1.138
Others (rc)				
Exposure to Mass Media				
No (rc)				
Yes	.103	.099	.299	1.109
-2LL			**10985.683**	
Total Sample			**15491**	

Note: (rc): Reference Category

Table 8: Relative Risk of Childhood Mortality for All Live Births: Hazard Regression Model Using Only Demographic and Spatial Variables

Predictor Variables	Coeff.	S.E.	Sig	Odd Ratio
Mother's Age				
<20 (rc)				
20-29	-.280	.112	.012	.756
30+	-.420	.143	.003	.657
Multiple Births				
No (rc)				
Yes	.145	.336	.667	1.155
Birth Order				
1 (rc)				
2-3	.564	.129	.000	1.758
4+	.952	.145	.000	2.590
Sex				
Male (rc)				
Female	.529	.076	.000	1.697
Region				
Bundelkhand (rc)				
Hill	-1.224	.233	.000	.294
West	-.564	.127	.000	.569
Central	.101	.131	.443	1.106
East	-.273	.121	.024	.761
Place of Residence				
Rural (rc)				
Urban	-.372	.112	.001	.689
-2LL		**13983.431**		
Total Sample		**19260**		

Note: (rc): Reference Category

After controlling the socioeconomic covariates, the effect of place of residence, age of the mother at child birth in mortality decreases but maternal education, especially the higher education, and living standard show very significant positive association with post-neonatal survival. Maternal work participation has been found to be mildly associated with child Mortality, hazards of child mortality for the children of working mothers is 1.2 times that for their non-working counterparts. The significant positive effect of living standard on child survival has been observed in this case after controlling all the demographic and socioeconomic covariates. Relative risk of childhood mortality is substantially lower, to 0.7 times and 0.5 times for the children living in the households of middle and high economic standard respectively than children from low economic standard households. More or less similar effects of region have been observed as in the case of neonatal and post-neonatal mortality and the relative hazards of childhood mortality are also low for the children of Hill, Western and Eastern region of Uttar Pradesh compared to children of Bundelkhand when all the spatial, demographic and socioeconomic variables are controlled. Higher maternal education continues to show its importance on child health as in the case of neonatal and post-neonatal period, revealing that the relative hazard of childhood mortality is very low, only 20 per cent of that for illiterate women. The effect of crowding has completely become invisible. Other socioeconomic variables such as religion, caste and exposure to mass media show no significant relationship with post-neonatal mortality.

Table 9: Relative Risk of Childhood Mortality for All Live Births: Hazard Regression Model Using Demographic, Spatial and Socioeconomic Variables

Predictor Variables	Coeff.	S.E.	Sig	Odd Ratio
Mother's Age				
<20 (rc)				
20-29	-.171	.118	.145	.843
30+	-.308	.151	.042	.735
Multiple Births				
No (rc)				
Yes	.249	.357	.486	1.282
Birth Order				
1(rc)				
2-3	.443	.135	.001	1.558
4+	.715	.153	.000	1.558
Sex				
Male (rc)				
Female	.503	.079	.000	1.653
Region				
Bundelkhand (rc)				
Hill	-1.280	.263	.000	.278
West	-.510	.142	.000	.601
Central	.107	.143	.457	1.112
East	-.267	.128	.037	.765
Place of Residence				
Rural (rc)				
Urban	-.028	.128	.828	.973
Standard of Living				
Low (rc)				
Medium	-.313	.087	.000	.731
High	-.793	.198	.000	.453
Maternal Education				
Illiterate (rc)				
Middle School complete	-.145	.127	.253	.865
Higher Educated	-1.357	.375	.000	.257
Mother's Work Status				
Not Working (rc)				
Working	.200	.088	.023	1.221
Crowding				
No (rc)				
Yes	-.097	.082	.239	.907
Religion				
Hindu (rc)				
Muslim	-.028	.117	.811	.972
Others	.278	.413	.500	1.321
Ethnicity				
Scheduled Caste / Tribe	.086	.104	.405	1.090
Other Backward Caste	-.047	.100	.642	.954
Others (rc)				
Exposure to Mass Media				
No (rc)				
Yes	.004	.096	.971	1.004
-2LL			**12618.199**	
Total Sample			**17731**	

Note: (rc): Reference Category

Tables 10 & 11 present the results of the relative risk of childhood mortality for second and higher birth orders. This analysis includes the length of the preceding birth interval as an additional explanatory variable as in the case of neonatal and post-neonatal period. The results are somewhat similar to those observed for all live births. The only exception is that the effect of mother's age at childbirth no longer remains significant when all covariates are controlled in the equation, which has also been observed in the case of post-neonatal period. In this case also, the relative hazards of childhood mortality have increased for the higher order births. The plausible explanation has already been discussed. The effect of place of residence has been significant when only demographic and spatial predictor variables are considered in the equation and urban children are having 0.7 times the hazards of mortality than their rural counterparts.

Table 10: Relative Risk of Childhood Mortality for Second and Higher Order Live Births: Hazard Regression Model Using Only Demographic and Spatial Variables

Predictor Variables	Coeff.	S.E.	Sig	Odd Ratio
Mother's Age				
<20 (rc)				
20-29	-.170	.134	.207	.844
30+	-.170	.163	.296	.844
Multiple Births				
No (rc)				
Yes	.114	.356	.750	1.120
Birth Order				
2 (rc)				
3	.444	.131	.001	1.559
4+	.517	.127	.000	1.677
Sex				
Male (rc)				
Female	.574	.082	.000	1.775
Birth Interval				
<24 Months (rc)				
24-48 Months	-.457	.082	.000	.633
>48 Months	-1.444	.215	.000	.236
Region				
Bundelkhand (rc)				
Hill	-1.202	.250	.000	.301
West	-.613	.135	.000	.542
Central	.068	.140	.629	1.070
East	-.313	.128	.014	.731
Place of Residence				
Rural (rc)				
Urban	-.414	.122	.001	.661
-2LL		**11825.508**		
Total Sample		**15179**		

Note: (rc): Reference Category

But its effect has been nullified by the other socioeconomic variables in the equation (Table 11). The effect of preceding birth interval continued to be very significant in the relative risk of childhood mortality, even after controlling all other predictor variables. It has been found that a child born after interval of 24-48 months of previous child has about 0.6 times the risk of mortality than those born within 24 months of previous birth. Risk decreases more as the length of preceding birth interval increases further. Standard of living of the household continues to show its significant positive impact for the higher order births also.

Table 11: Relative Risk of Childhood Mortality for Second and Higher Order Live Births: Hazard Regression Model Using Demographic, Spatial and Socioeconomic Variables

Predictor Variables	Coeff.	S.E.	Sig	Odd Ratio
Mother's Age				
<20(rc)				
20-29	-.071	.142	.615	.931
30+	-.062	.172	.719	.940
Multiple Births				
No (rc)				
Yes	.207	.382	.587	1.230
Birth Order				
2 (rc)				
3	.357	.137	.009	1.429
4+	.372	.135	.006	1.451
Sex				
Male (rc)				
Female	.545	.085	.000	1.724
Birth Interval				
<24 Months (rc)				
24-48 Months	-.438	.086	.000	.645
>48 Months	-1.591	.241	.000	.204
Region				
Bundelkhand (rc)				
Hill	-1.279	.287	.000	.278
West	-.534	.151	.000	.586
Central	.103	.154	.502	1.109
East	-.292	.137	.033	.747
Place of Residence				
Rural (rc)				
Urban	-.145	.139	.299	.865
Standard of Living				
Low (rc)				
Medium	-.351	.094	.000	.704
High	-.830	.213	.000	.436
Maternal Education				
Illiterate (rc)				
Middle School complete	-.064	.136	.640	.938
Higher Educated	-1.225	.429	.004	.294
Mother's Work Status				
Not Working (rc)				
Working	.180	.094	.055	1.197
Crowding				
No (rc)				
Yes	-.131	.089	.139	.877
Religion				
Hindu (rc)				
Muslim	-.068	.125	.588	.935
Others	-.355	.581	.542	.701
Ethnicity				
Scheduled Caste / Tribe	.134	.111	.226	1.143
Other Backward Caste	-.073	.108	.501	.930
Others (rc)				

Table 11 (contd.)

(contd.)

Predictor Variables	**Coeff.**	**S.E.**	**Sig**	**Odd Ratio**
Exposure to Mass Media				
No (rc)				
Yes	.086	.102	.398	1.090
-2LL			**10612.612**	
Total Sample			**13960**	

Note:
rc: Reference Category

It has been found that higher order children of middle and higher income households have less relative risk of mortality; 0 .7 times that for the children of low income households. The effect of maternal work is quite small. All other demographic, socioeconomic and spatial variables are found to have more or less similar effect on childhood mortality for second and higher birth order children.

Conclusions and Policy Recommendations

It has been well established now from our findings that primarily the endogenous factors are playing significant role on neonatal mortality, whereas in the post-neonatal as well as in the childhood period, primarily exogenous factors affect risk of mortality much. But the positive effect of maternal education, being exogenous, seemed to have a great impact on infant and child survival irrespective of the age of the child. On the other hand, length of the preceding birth interval, being endogenous, also seemed to have very strong impact on infant and child survival.

No religion and caste differential in infant and childhood mortality have been found in this analyses after controlling for other socioeconomic variables.

What are the policy implications of these findings? Those covariates most subject to intervention are maternal education, poverty and strong son preference in this state. These findings indicate that a decline in fertility, by reducing the proportion of higher order births will tend to lower the overall level of child mortality. Reducing this large proportion of births to very young mothers will definitely lower neonatal mortality. One clear implication of our finding is that effective programs to reduce teenage childbearing would lower neonatal mortality heavily.

For children who are not first born, previous birth interval has one of the largest effects on infant and child mortality of any factor analyzed here. Because more than one-third of second and higher order children in this state are born within 24 months of the previous birth, a program that encourages women to space births to intervals of at least 24 months would have a major impact in the reduction of infant and child mortality.

The importance of maternal education has been well established and widely accepted. Maternal education influences child survival through various pathways: raising the age at marriage, enhance socioeconomic status, greater health choice for children, including interaction with medical personnel, cleanliness, emphasis on child quality (Caldwell, 1979; Ware, 1984). Our study is in agreement with the earlier findings that the maternal education is a decisive determinant of child survival including during the neonatal period even after controlling a number of demographic, socioeconomic and spatial variables. So the policy should focus to enhance maternal education at the earliest.

Though the potential role of income related factors in child survival is complex mainly due to multifaceted nature of income itself, our findings clearly indicate that household income (or, to be precise, standard of living, as employed in the analyses) has very positive significant role for the survival of the children. Higher living standard is associated with better rearing of children in terms of nutrition; healthcare etc. would significantly reduce the risk of later childhood mortality and support the earlier findings in this aspect (Pandey *et. al*., 1998). However, it is widely recognized that substantial rises in the

level of income may not be feasible in the near future. Therefore, public health and nutrition programs must make greater efforts to meet the needs of the poor.

Excess mortality for girls in the post-neonatal and childhood period clearly indicates the fact that a strong son-preference exists in this state and further that it operates on child survival. Son preference in this state is due to traditional patriarchal family system that assigns many privileges and duties to sons (Arnold, Choe and Roy, 1998; Caldwell, Reddy and Caldwell, 1989; Kishor, 19965, Koenig and Foo, 1992). At marriage, dowry payments impose a heavy financial burden on parents of girl, which may cause parents to desire more sons than daughters and to discriminate against daughter. It will be difficult to eliminate son preference in a short period of time, but maternal and child healthcare programs that provide supplemental nutrition and basic health care to all children, regardless of sex, may help to reduce excess female mortality.

As expected, the positive relation between mother's employment, and post-neonatal and childhood mortality in this state, as elsewhere in India, has been observed. The chances of post-neonatal and child survival decrease to some extent if mother works. But this does not in any way imply that mothers' employment should be discouraged. Instead, it suggests that society and culture have not adopted to ensure that alternatives for childcare are available to women who work, irrespective of whether they work out of choice or necessity. The higher mortality of children if mother works reflects that employment for women is in addition to their traditionally ascribed roles. Unless gender roles and gender relation are renegotiated, children will continue to lose.

Finally, though the maternal and child healthcare factors like antenatal care, delivery care, immunization of mothers and children have not been included in this analyses but it is regarded that these factors would have a substantial effect in reducing, especially, neonatal and post-neonatal mortality. The maternal education and standard of living are likely to be associated with healthcare variables such as antenatal care, delivery care, immunization etc. This has also observed from various analyses of NFHS data (Pandey *et.al.*, 1998; Rajna *et. al.,* 1998*)*. Therefore, non-inclusion of these variables is likely to overestimate the direct effects of maternal education and standard of living. Observed effects therefore include the direct effects as well as indirect effects through healthcare variables. Family health program should be strengthened to provide these basic healthcare services to all pregnant women.

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Appendix

Table: 1 Result of Logistic Regression for Demographic and Spatial Variables for All Births:

Variable	Coeff.	S.E.	Sig	Odd Ratio
Mother's Age				
<20 (rc)				
20-29	-.601	.078	.000	.548
30+	-.565	.105	.000	.568
Multiple Births				
No (rc)				
Yes	2.017	.121	.000	7.519
Birth Orders				
1 (rc)				
2-3	-.249	.079	.002	.780
4+	.105	.095	.267	1.111
Sex				
Male (rc)				
Female	-.055	.523	.469	.961
Region				
Bundelkhand (rc)				
Hill	-.736	.154	.000	.479
Western	-.303	.097	.002	.739
Central	.035	.105	.966	1.035
Eastern	-.075	.094	.423	.928
Place of Residence				
Rural (rc)				
Urban	-.358	.083	.000	.699
Constant		-2.056		
-2LL		10495.353		
Total Sample		22909		

Table: 2 Result of Logistic Regression for Demographic, Spatial & Socioeconomic Variables for All Births

Variable	Coeff.	S.E.	Sig	Odd Ratio
Mother's Age				
<20 (rc)				
20-29	-.526	.082	.000	.591
30+	-.476	.110	.000	.621
Multiple Births				
No (rc)				
Yes	2.042	.128	.000	7.705
Birth Orders				
1(rc)				
2-3	-.293	.083	.000	.746
4+	-.024	.101	.811	.976
Sex				
Male (rc)				
Female	-.044	.057	.440	.957

(Contd..)

Variable	Coeff.	S.E.	Sig	Odd Ratio
Region				
Bundelkhand (rc)				
Hill	-.710	.170	.000	.429
Western	-.202	.107	.059	.817
Central	.109	.114	.336	1.116
Eastern	-.069	.100	.487	.933
Place of Residence				
Rural(rc)				
Urban	-.122	.095	.199	.885
Standard of Living				
Low (rc)				
Medium	.002	.066	.981	1.002
High	-.134	.123	.277	.875
Maternal Education				
Illiterate (rc)				
Middle School Completed	-.249	.090	.006	.779
Higher Educated	-.632	.170	.000	.532
Mother's Work Status				
Not-Working (rc)				
Working	.093	.067	.168	1.097
Crowding				
No (rc)				
Yes	-.294	.060	.000	.745
Religion				
Hindu (rc)				
Muslim	-.166	.088	.061	.847
Others	-.066	.321	.837	.936
Ethnicity				
Others (rc)				
Scheduled Castes & Scheduled Tribes	.029	.079	.716	1.029
Other Backward Castes	.127	.071	.076	1.135
Exposure to Mass Media				
No (rc)				
Yes	-.042	.069	.546	.959
Constant			-1.913	
-2LL			9657.551	
Total Sample			21107	

Table: 3 Result of Logistic Regression for Demographic and Spatial Variables for Second and Higher Order Births

Variable	Coeff.	S.E.	Sig	Odd Ratio
Mother's Age				
<20 (rc)				
20-29	-.423	.103	.000	.655
30+	-.200	.127	.115	.819
Multiple Births				
No (rc)				
Yes	2.067	.134	.000	7.900
Birth Orders				
2 (rc)				
3	-.172	.106	.105	.842
4+	.158	.098	.106	1.172
Sex				
Male (rc)				
Female	-.025	.065	.704	.976
Birth Interval				
<24 Months (rc)				
24-48 Months	-.687	.068	.000	.503
>48 Months	-1.426	.151	.000	.240
Region				
Bundelkhand (rc)				
Hill	-.817	.193	.000	.442
Western	-.353	.115	.002	.703
Central	.055	.125	.657	1.057
Eastern	-.026	.110	.815	.975
Place of Residence				
Rural (rc)				
Urban	-.335	.098	.001	.715
Constant		-1.936		
-2LL		7607.146		
Total Sample		17967		

Table: 4 Result of Logistic Regression for The Demographic & Socioeconomic Variables for Second and Higher Order Births

Variable	Coeff.	S.E.	Sig	Odd Ratio
Mother's Age				
<20 (rc)				
20-29	-.325	.108	.003	.722
30+	-.077	.134	.567	.926
Multiple Births				
No (rc)				
Yes	2.099	.145	.000	8.161
Birth Orders				
2 (rc)				
3	-.218	.110	.048	.805
4+	.038	.104	.716	1.039
Sex				
Male (rc)				
Female	-.012	.067	.853	.988

Variable	Coeff.	S.E.	Sig	Odd Ratio
Birth Interval				
<24 Months (rc)				
24-48 Months	-.721	.071	.000	.486
>48 Months	-1.485	.159	.000	.226
Region				
Bundelkhand (rc)				
Hill	-.765	.216	.000	.465
Western	-.203	.127	.110	.816
Central	.150	.135	.266	1.162
Eastern	.002	.118	.983	1.002
Place of Residence				
Rural (rc)				
Urban	-.083	.112	.456	.920
Standard of Living				
Low (rc)				
Medium	-.001	.077	.993	.999
High	-.145	.148	.328	.865
Maternal Education				
Illiterate (rc)				
Middle School Completed	-.199	.110	.070	.820
Higher Educated	-.708	.233	.002	.493
Mother's Work Status				
Not Working (rc)				
Working	.140	.077	.069	1.151
Crowding				
No (rc)				
Yes	-.327	.071	.000	.721
Religion				
Hindu (rc)				
Muslim	-.191	.102	.061	.826
Others	-.106	.384	.782	.899
Ethnicity				
Others (rc)				
Scheduled Castes & Scheduled Tribes	.035	.093	.705	1.036
Other Backward Castes	.154	.084	.067	1.167
Exposure to Mass Media				
No (rc)				
Yes	-.096	.082	.245	.909
Constant			-1.840	
-2LL			6957.369	
Total Sample			16529	

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