DIFFERENTIALS AND DETERMINANTS OF INFANT AND CHILD MORTALITY IN RURAL INDIA

ABSTRACT

The present study examines the trend and differentials in infant and child mortality among three mortality groups of states, which are grouped as low, medium and high mortality groups according to their level of under five mortality rates. The results indicate that the low mortality group of states are better placed in terms of housing conditions, fertility and the level of utilisation of maternal and child care services compared to high and medium mortality group of states. Though infant and child mortality rates have declined substantially in all mortality groups in the 15 years period prior to survey (1978-92), the levels observed for the period 1988 to 1992 indicate that both infant and child mortality rates were significantly high among the high mortality group compared to medium and low mortality groups. Neonatal mortality rates constitute more than 60 percent of infant deaths in all mortality groups. The significant association of various demographic, socio-economic and maternal care variables with infant and child mortality suggest the need for area specific health care delivery system for rural areas. The persistence of high infant and child mortality rates observed among the high mortality group of states deserves special attention.

Introduction

Infant and child mortality rates are considered as sensitive indicators of living and socio-economic conditions of a country. This recognition has made the international organisations as well as National Governments to intensify their efforts to reduce infant mortality and improve child survival. As a result, there have been considerable improvements in the infant and child mortality rates for the world as a whole in recent years. In India the infant mortality has improved over time. It has decreased by 14.73 percent between 1971 and 1981, 27.27 percent between 1981 and 1991 and by about 15 percent between 1991 and 2001. Most infant deaths occur in the first month of life; up to 47 percent in the first week itself. While the infant mortality rate slowed a rapid decline during the 1980's, the decrease has showed down during the past decade according to the sample registration system, office of the Registrar General of India (2000 figures).

Overall, under 5 mortality rate was brought down to 93/1000 in 2001 from 123/1000 in 1990. And the infant mortality rate was brought down from 80/1000 in 1990 to 67/1000 in 2001 (HDR 2003). The infant mortality rates are substantially higher in rural areas (74 in rural and 43 in urban). The variation in infant mortality rate among the various states in India is great ranging from 16/1000 live births in Kerala to 98/1000 live births in Orissa. (Registrar General of India, 2004).

Though infant and child mortality declined appreciably in both urban and rural areas, the persistence of the high incidence of infant and child mortality in rural areas, the vast gap between the rural and urban areas and the variations, among various states within India have drawn the attention of Governments to intensify their efforts to improve child health and survival with special emphasis for rural areas.

An attempt has been made in this study to critically analyse the level, trends, differentials and determinants of infant and child mortality in Rural India and examine the influence of various socio-economic, demographic and health care factors on infant and child mortality.

Objectives

1. To Study the variations in the fertility behaviour and of maternal and child care practices among women in Rural India.
2. To study the levels, trends and differentials in infant and child mortality in Rural India;
3. To study the influence of socio-economic, demographic, maternal health care and mass media variables on infant and child mortality;
4. To study the effects of selected socio-economic, demographic and maternal health care variables on infant and child mortality; and
5. To suggest viable strategies to improve infant and child survival in Rural India.

Data Source

The data for the present study were taken from the National Family Health Survey-I (NFHS-I) conducted during 1992-93 in 25 states of India. A total of 62,243 ever married women (aged 13-49) in rural and 27,534 ever married women in urban areas were interviewed for NFHS-I. As the present study focus mainly on the determinants of infant and child mortality in Rural India, the data related to rural areas of the 25 states of India are taken for the analysis of the present study.

Grouping of States

According to the findings of the NFHS, 1992-93, the variation in under-five mortality rates in India was great, ranging from 142 per 1000 live births for Assam to 21 per 1000 live births for Nagaland. In order to have a better understanding of the reasons for the variations and to identify the specific factors operating on infant and child mortality, all the 25 states were grouped into three categories as Low, Medium and High mortality group of states according to their level of under-five mortality rates as per the NFHS, 1992-93(Table 1).

Table 1 Distribution (Grouping) of States according to their level of under-five mortality rates (1992-93).		
High Mortality Group (105-142)	**Medium Mortality Group (87-104)**	**Low Mortality Group (86 or less)**
Assam	Andhra Pradesh	Arunachal Pradesh
Bihar	Gujarat	Delhi
Madhya Pradesh	Haryana	Goa
Orissa	Karnataka	Himachal Pradesh
Tripura	Mehalaya	Jammu
Uttar Pradesh	Rajasthan	Kerala
	West Bengal	Maharastra
		Manipur
		Mizoram
		Nagaland
		Punjab
		TamilNadu

Figures in parentheses are the range of under 5 mortality rates of the states included in the group.

Data Analysis

After having grouped the states into three categories as Low, Medium and High mortality groups, the data related to the rural areas of the three groups of   states were analysed separately and compared.

First, a univariate analysis of infant and child mortality rates by different background characteristics of mother and child was made.

The mortality measures used are:

Neonatal mortality   : the probability of dying during the first month of life.

Post neonatal mortality   : the difference between infant and neonatal mortality.

Infant mortality ($1q_0$)   : the probability of dying before 12 months of age.

Child mortality ($4q_1$)   : the probability of dying between exact ages 1& 5 years.

Under-five mortality ($5q_0$) : the probability of dying before five years of age.

The mortality estimates are not rates, but are true probabilities, calculated according to the conventional life table approach. For any calendar period, deaths and exposure in that period are first tabulated for the age intervals 0, 1-2, 3-5, 6-11, 12-23, 24-35, 36-47 and 48-59 months. Then age-interval-specific probabilities of survival are calculated, denoted as q_i. Finally, probabilities of death over larger age intervals are calculated by multiplying the relevant age-interval survival probabilities together and subtracting the product from one:

$$nqx = 1 - \pi_i (1-qi)$$

The trends in infant and child mortality rates were derived directly from the maternity history data for three quinquennial periods preceding the survey for the three mortality groups. The mortality estimates by demographic and socio-economic characteristics were made for 10 years period preceding the survey. However, the mortality estimates by maternal care variables were made for the four years period preceding the survey as these information were collected only for four years preceding the survey. The univariate analysis of mortality estimates was made to see the intra group and inter-group variations according to selected background characteristics of the parents and child.

Multivariate analysis was also adopted in order to estimate the independent effects of each variable when other variables are controlled. The method adopted for the multivariate analysis was proportional hazard models.

The dependent variable in the multivariate analysis is a measure of the force of mortality for an individual i, in the age interval t and is given by $\lambda_i(t)$. The hazard in the age interval t, which can be interpreted as the probability of dying between t and delta-t, given that the child has survived at the beginning of the age interval, is assumed to have the following functional form.

In $[\lambda_i (t)] = \alpha (t) + x_i (t) \beta (t)$

Where $\lambda_i(t)$, is the risk of dying in age interval t for child i

$\exp (\alpha(t))$ is the underlying age specific risk of dying

$x_i(t)$ is a vector of characteristics for individual i and

$\beta (t)$ is the set of associated co-efficients

Estimates of the coefficients β (t), when exponentiated, can be interpreted as the risk associated with a set of characteristics x_i (t), related to an omitted reference category.

Coefficients are estimated using maximum likelihood methods and Z- statistics (the estimated coefficient divided by the standard error) is used to assess whether an effect is statistically significant.

Four different proportional hazard models were considered in the multivariate analysis to see the relative risk of dying through ages 0-11 months and 1-4 years for births during the 4 years preceding the survey. The first model assesses the relative risk of sex of the child, mother's age at the time of child's birth, religion, caste, mother's standard of living and mother's education on infant and child mortality. The second model assesses the relative risk of birth order, mother's age at the time of child's birth and mother's education on infant and child mortality. The third model assesses the relative risk of sex of the child, mother's age at birth, sex composition of older surviving siblings, interaction term between sex of the child and sex composition of older surviving siblings and mother's education on infant and child mortality. The fourth model assesses the relative risk of antenatal care, Tetanus Toxoid, place of delivery and mother's education on infant and child mortality.

RESULTS

Background characteristics of mortality groups

Variations in infant and child mortality rates are the reflection of the prevailing housing conditions, fertility behaviour of women and the utilization of maternal health care services. Hence, a comparative analysis of the data related to the housing conditions, fertility behaviour and utilization of maternal health care services in the three mortality groups of States was made and the results are presented in table 2.

The comparison of housing conditions among the three mortality groups revealed that the housing conditions in terms of type of house, electrification, toilet facility and place of keeping animals during night were much better in the low and medium mortality groups compared to high mortality group.

The crude birth rate, total fertility rate and general fertility rates were high for high mortality group followed by medium and low mortality groups. However, there was not much difference between the low and medium mortality groups with regard to various fertility measures. The comparison of total fertility rate among the three mortality groups revealed that the high mortality group had experienced high fertility (5.7) compared to medium (4.9) and low (4.3) mortality groups. The mean number of children ever born to women age 40-49 was also highest at 5.7 for high mortality group compared to 4.9 for medium and 4.3 for low mortality groups. The child loss as measured by the difference between the mean number of children ever born and surviving was comparatively higher for women in high mortality group (0.6) which was followed by medium (0.4) and low mortality groups (0.3).

Utilisation of maternal care services such as antenatal care visits, immunisation during pregnancy (Tetanus Toxoid), place of delivery, person attended delivery are likely to have significant influence on child survival. An examination of the variations in the level of utilisation of various maternal care services indicated marked differences in the utilisation of maternal care services among the three mortality groups. Among those who have received antenatal care, the median number of antenatal care visits was slightly higher in the low mortality group (4.4) as compared to medium (3.8) and high mortality (2.9) groups. There was not much difference in the median months of gestation at first antenatal care visit among the three mortality groups. It was about 5 months for all mortality groups.

The proportion of women who had availed two doses of T.T vaccination during pregnancy was highest at 74 per cent in low mortality group compared to only 58 per cent in medium and just 33 per cent in high mortality group. Majority of deliveries in all mortality groups took place at home. However, the proportion of institutional deliveries was comparatively high (37 per cent) in the low mortality group as compared to 19 per cent in medium and just 7 per cent in high mortality groups. The proportion of deliveries attended by trained health personnel was only 15 per cent in high mortality group where as it was 29 per cent in the medium and 49 per cent in the low mortality groups. Thus the results indicated that the utilisation of various maternal care services was comparatively better in the low mortality group compared to medium and high mortality groups.

Variables	Mortality Group		
	High	Medium	Low
Table 2 Selected indicators of housing, fertility and utilization of maternal Health care services in high, medium and low mortality group of states, Rural India, 1992-93			
Housing Characteristics			
i) Percent of pucca households	5.8	16.2	15.2
ii) Percent of households electrified	21.7	46.2	64.1
iii) Percent of households with toilet facilities	9.4	12.2	21.5
iv) Percent of households keeping animals inside the house at night	24.5	19.0	9.2
Fertility Measures (1990-92)			
i) Total Fertility Rate	4.3	3.2	3.1
ii) General Fertility Rate	150.0	121.0	113.0
iii) Crude Birth Rate	32.9	26.8	23.4
iv) Mean number of children ever born to women age 15-49	3.4	3.0	2.9
v) Mean number of children surviving	2.8	2.6	2.6
vi) Mean number of children ever born to women age 40-49	5.7	4.9	4.3
vii) Percent of higher order births (3+)	56.5	46.6	41.2
Maternal Health Care Services			
i) Number of Antenatal Care visits (Median)	2.9	3.8	4.4
ii) Months of pregnant at first antenatal visit (Median)	5.4	5.1	4.9
iii) Percent availed T T immunization (Two doses)	33.2	57.5	74.0
iv) Percent of Institutional delivery	7.3	18.8	37.2
v) Percent of delivery attended by Trained Health personnel	14.5	29.3	48.9

# UNIVARIATE ANALYSIS OF INFANT AND CHILD MORTALITY

Levels and Trends

Infant and child mortality rates for the three quinquennial periods preceding the survey for the three mortality groups are presented in Table 3. The infant and child mortality rates that prevailed during the five years preceding the survey (approximately 1988-92) as estimated from the birth history data revealed vast variations in the levels of infant and child mortality rates among the three mortality groups. The infant and child mortality rates were lowest at 57 and 21 per 1000 live births respectively for the low mortality group compared to the rates of 73 and 32 respectively, estimated for the medium mortality group and 101 and 48 respectively, estimated for the high mortality group. The proportion of neonatal deaths to infant deaths was 61 per cent in the high mortality group, 63 per cent in the medium mortality group and 68 per cent in the low mortality group (Figure 1).

Table 3 Infant and Child mortality rates for five years periods preceding the survey, Rural India, 1992 - 93.

Years before Survey	High							Medium							Low						
	NNM	PNM*	IM	CM	U5M			NNM	PNM*	IM	CM	U5M			NNM	PNM*	IM	CM	U5M		
0 - 4	61.4	39.9	101.3	47.6	144.1			46.2	27.0	73.2	31.5	102.4			38.9	18.2	57.1	20.5	76.4		
5 - 9	74.1	52.4	126.5	55.5	175.0			55.3	31.1	86.4	35.3	118.7			39.9	24.1	63.9	25.9	88.1		
10 – 14	79.1	61.2	140.3	67.7	198.6			56.1	36.0	92.0	45.8	133.6			44.1	25.3	69.4	41.8	108.3		

NNM - Neonatal mortality/PNM – Post neonatal mortality/IM - Infant mortality ($1q_0$) / CM - Child mortality ($4q_1$) / U5M - Under - five mortality ($5q_0$)

* Computed as the difference between infant and Neonatal mortality rates

Figure 1: INFANT, NEONATAL AND POST NEONATAL MORTALITY RATES BY MORTALITY GROUPS (1988-92)
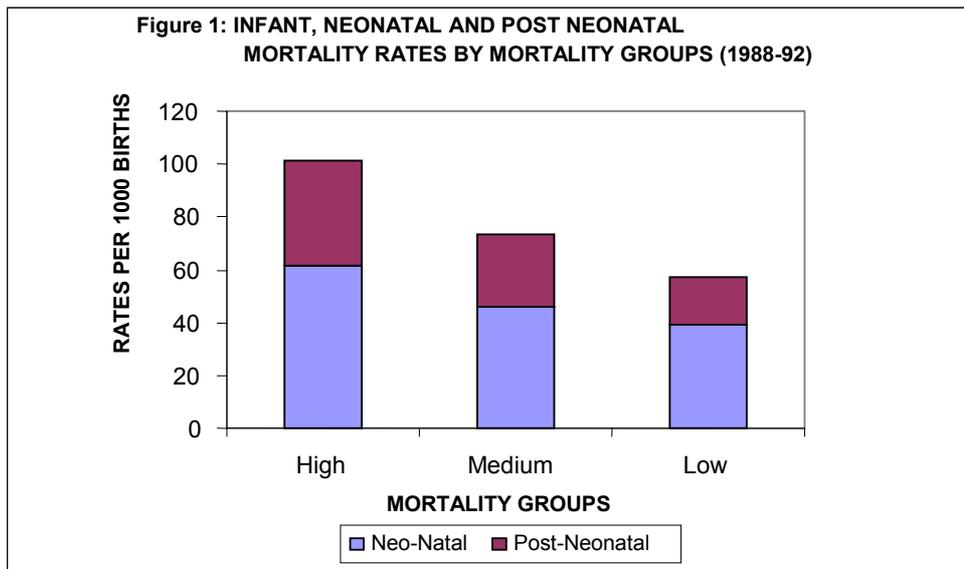
The per cent decline of infant mortality was high in the high mortality group (28 per cent) compared to medium (20 per cent) and low (18 per cent) mortality groups. This is so because of the fact that infant mortality rates were comparatively at low level during the reference period of 15 years in the medium and low mortality groups. The child mortality decline was highest at 51 per cent in low mortality group compared to around 30 per cent observed for medium and high mortality groups.

Though unequal between the mortality groups, the declines have been substantial in all mortality groups. The pace of decline of infant mortality was very fast in the high mortality group as compared to medium and low mortality groups. There was not much difference between the medium and low mortality groups in the pace of decline of infant mortality. Though the decline of infant mortality was high in the high mortality group, the infant mortality rate continued to be high in the high mortality group as compared to medium and low mortality groups. While the decline of infant mortality rate was high in the high mortality group, the decline of child mortality rate was high in the low mortality group. The fast decline observed in the child mortality rate among the children of low mortality group indicate the improvements in the delivery of health care services and adoption of appropriate health care measures by mothers in the low mortality group.

Socio-Economic Factors and Infant and Child Mortality.

The Infant and Child Mortality estimates for 10 years period preceding the survey by selected socio economic characteristics of the mothers presented in table 4 indicate substantial variation in infant and child mortality rates among the three mortality groups. The infant mortality rates varied from a high of 114 in high mortality group to a low of 61 in low mortality group and child mortality rates varied from a high of 51 in high mortality group to a low of just 23 in low mortality group. Both the infant and child mortality risks were much higher among the children of Hindu than the children of other religions in all mortality groups except for child mortality in the medium mortality group where the risk was more among Muslims than others.

Both infant and child mortality rates were observed to be high among the children of Scheduled Caste in all mortality groups except for child mortality in the medium mortality group where it was high among the children of Scheduled Tribe. Increase in education reduces the level of infant and child mortality rates in all mortality groups. The variations observed among the three mortality groups narrowed down at higher level of education of parents. Infant mortality rate was lower among the children of self employed mother than others in all mortality   groups. While the child mortality was low among children of self employed mothers in high mortality group it was low among non-working mothers (house wives) in the medium and low mortality groups.

There was not much variation both in infant and child mortality rates due to mother's standard of living in all mortality groups. The comparison of infant and child mortality rates among the three mortality groups revealed that even at the low level of standard of living, both the infant and child mortality rates were very low among the children of low mortality group as compared to medium and high mortality groups. The results indicate that the economic development is not a pre-requirement for the decline of infant and child mortality.

Socio – economic Characteristics	Infant Mortality			Child Mortality		
	High	Medium	Low	High	Medium	Low
Religion						
Hindu	115.8	80.9	65.8	51.9	33.5	23.9
Muslim	106.9	80.8	40.6	47.3	35.6	14.9
Christian	70.5	72.8	40.1	60.1	10.6	17.1
Sikh	77.0	41.0	50.7	52.3	24.1	21.0
Jain	-	16.9	-	-	52.9	-
Buddhist	64.6	43.9	66.0	125.1	36.9	37.2
Others	133.7	69.2	78.8	61.7	17.8	80.1
Caste						
Scheduled Caste	137.0	95.6	80.6	65.7	37.2	35.4
Scheduled Tribe	107.4	86.5	61.0	62.1	44.7	31.8
Others	111.1	75.9	56.6	47.3	30.6	19.7
Education (Mother)						
Illiterate	121.5	85.6	72.5	56.9	37.0	30.4
Literate & Primary	83.7	66.4	50.1	30.1	26.6	16.7
Middle Complete	75.0	60.4	39.9	12.9	6.9	8.5
High School & Above	59.1	46.4	36.8	9.2	7.8	7.2
Education (Father)						
Illiterate	129.9	89.6	81.4	67.1	39.7	32.2
Literate & Primary	110.7	76.3	60.8	48.0	33.3	21.1
Middle Complete	113.5	71.4	47.4	42.2	26.5	20.6
High School & Above	83.9	63.4	36.9	25.3	16.7	13.9
Working Status (Mother)						
Not working	105.7	75.7	50.3	48.9	32.9	17.1
Working for family	115.4	73.1	62.5	69.7	37.2	25.1
Working for some-one else	111.5	77.8	71.7	72.4	39.4	39.6
Self employed	66.1	63.6	31.6	39.6	31.8	43.3
Standard of living index (SLI)						
Low	105.3	73.0	63.8	49.9	33.9	25.9
Medium	97.8	75.7	52.0	46.1	28.5	15.9
High	97.2	66.5	49.9	42.8	30.6	15.6
Total	**114.2**	**80.2**	**60.6**	**51.4**	**33.3**	**23.2**

Table 4 Infant and child mortality rates for the ten years period preceding the Survey by selected socio - economic characteristics, Rural India, 1992 -93.

Demographic Factors and Infant and Child Mortality

Infant and child mortality rates by selected demographic characteristics are presented in table 5. The infant mortality rates by age of mother showed a U shaped relationship with the observation of higher level of infant mortality among mothers aged less than 20 and more than 30 years in all mortality groups. However, no such relationship was observed for child mortality. Infant mortality rates were higher for first and higher order births (4+) than others in all mortality groups.

Child mortality rates were comparatively high among higher order births in all mortality groups. Both the infant and child mortality rates were observed to be high among children born less than 2 years following the birth of its preceding sibling in all mortality groups.

Fewer female than male die during infancy in all mortality groups, although the female advantage reversed among children aged 1-4 years. The excess male infant mortality was observed to be highest at 11 percentage points in low mortality group as compared to only 3 percentage points in high and just one percentage point in medium mortality group. The excess female mortality observed at ages 1 - 4 years was 9 times higher for high mortality group and 6 times higher for medium mortality group as compared to the low mortality group. The variations observed in the excess female mortality at ages 1 - 4 years among the three mortality groups revealed that the sex bias was more prevalent in the high and medium mortality groups than in the low mortality group.

Table 5 Infant and child mortality rates for the ten years period preceding the Survey by selected demographic characteristics, Rural India, 1992 - 93.						
Demographic Characteristics	Infant Mortality			Child Mortality		
	High	Medium	Low	High	Medium	Low
Age of Mother						
< 20	139.3	99.8	78.4	54.7	34.3	23.4
20 – 29	104.8	67.6	51.8	51.2	32.8	23.1
30 – 39	110.4	87.4	64.2	45.8	33.1	23.5
40 – 49	132.4	89.4	67.0	81.7	29.6	5.1
Birth Order						
1	131.2	92.9	64.3	41.2	27.6	15.4
2	106.6	71.4	54.5	47.5	33.4	19.3
3	94.1	68.2	56.5	56.1	33.0	26.4
4	107.0	69.9	59.0	52.5	30.8	35.2
5	110.2	75.5	73.7	60.3	38.5	29.6
6	112.4	91.7	71.9	49.5	33.7	27.1
7+	140.0	113.8	67.7	63.9	54.9	37.0
Previous Birth Interval (Months)						
< 24	172.3	116.5	90.3	82.3	47.7	31.2
24 – 47	87.7	61.3	45.6	46.7	33.7	26.8
48 +	49.5	39.0	38.1	20.2	13.5	13.2
Sex of Child *						
Male	115.6	80.6	66.2	42.3	27.3	22.2
Female	112.6	79.8	54.6	61.2	39.5	24.2
Birth weight *						
< 2.5 Kg.	131.7	78.0	84.6	46.2	20.0	19.3
2.5 kg or More	144.3	60.7	31.6	43.2	19.4	19.6
* Rate for the four years period preceding the survey.						

Though birth weight is expected to have significant influence on the chances of survival of children during infancy and childhood, the results of the present study indicate a higher level of infant mortality rate among the children of normal birth weight than the children of low birth weight in the high mortality group. However, in the case of medium and low mortality groups, the infant mortality rates were higher among the low birth weight children than the normal birth weight children. It was also observed that there was not much difference in the child mortality rates   between the low birth weight and normal birth weight children in all mortality groups. Variations in the infant mortality rates among the three mortality groups   were substantial for both low birth weight and normal birth weight children. Even among children born with normal birth weight, the chances of dying during infancy was more than four times higher in the high mortality group (144) and nearly two times higher in the medium mortality group (61) as compared to the low mortality group (32). In the case of child mortality, there was not much difference between the medium and low mortality groups. However, the chances of normal birth weight children dying during childhood was more than two times higher in the high   mortality group(43) as compared to the low mortality group(20).

Maternal Care Factors and Infant and Child Mortality

Infant and child mortality rates by maternal care variables presented in table 6 showed substantial variations in the infant and child mortality rates among the three mortality groups. However, the differences narrowed down significantly with the increase in the number of antenatal care visits. In all mortality groups, both the infant and child mortality rates declined considerably when the mother availed both antenatal and delivery care from trained health personnel. The variation observed in the infant and child mortality rates among the three mortality groups was great when the mother did not receive both antenatal and delivery care from trained   health personnel.

While the infant mortality rate was high among children whose birth took place at home in low mortality group, it was high among children whose birth took place at public sector facilities in the medium and high mortality groups. The results indicate the need for improvements in the quality of services provided by the public sector facilities in the high and medium mortality groups.

In the case of delivery attendants, both the infant and child mortality rates were low among births attended by trained health personnel and were high among births attended by untrained personnel in all mortality groups.

Maternal care variables	Infant Mortality			Child Mortality		
	High	Medium	Low	High	Medium	Low
Antenatal Visit						
None	113.1	80.6	78.2	54.9	39.1	18.4
1 – 3	76.9	73.4	57.2	36.7	31.9	21.3
4 + visits	65.0	56.7	42.3	31.2	21.1	17.6
Medical Maternity Care						
No antenatal and delivery care	107.3	75.3	83.0	60.3	41.3	39.1
Either antenatal or delivery care	72.9	72.1	48.2	32.9	24.7	16.8
Both antenatal and delivery care	57.1	52.3	43.7	11.6	24.0	17.5
Place of delivery						
Public Sector Facility	106.5	69.3	39.9	13.9	18.2	36.1
Private Sector Facility	39.5	60.6	47.0	8.1	6.7	7.4
Home	92.2	66.6	55.6	50.3	34.5	17.1
Birth Attendant						
Doctor	90.5	63.5	45.8	23.6	19.9	15.8
Nurse/Mid Wife	79.0	61.1	45.5	35.9	23.6	17.6
Traditional Birth Attendant	95.4	71.1	57.0	49.4	34.5	20.8
Relatives/Others	104.7	76.9	70.1	49.4	34.8	24.1
Total	**101.3**	**73.2**	**57.1**	**47.6**	**31.5**	**20.5**

Table 6   Infant and child mortality rates for the four years period preceding the Survey by selected maternal care variables, Rural India, 1992 - 93.

Infant and child mortality by exposure to mass media

Mass media is playing a vital role in propagating the health care messages among the rural mass. Children of mothers who had exposure to mass media are likely to have low risk of infant and child mortality as compared to those who had not.

The results presented in table 7 indicate that both infant and child mortality rates declined considerably when the mother exposed to any mass media in all mortality groups. The results suggest that the effective use of mass media to propagate health and family welfare messages will help to reduce infant and child mortality in rural areas.

Exposure to mass Media	Infant Mortality			Child Mortality		
	High	Medium	Low	High	Medium	Low
Not exposed any media	119.1	84.5	65.3	56.5	37.6	28.0
Exposed to media	99.7	75.1	57.2	36.1	28.0	19.6
Watch TV once a week	78.7	74.5	52.1	24.0	21.9	16.6
Listen Radio once a week	100.0	76.7	55.2	35.3	29.7	18.2
Visit cinema once a month	75.9	68.1	70.9	40.5	24.5	25.1

Table 7   Infant and child mortality rates for the ten years period preceding the survey by exposure to mass media, Rural India, 1992-93

Results of Multivariate Analysis

The results of the multivariate analysis are presented in Tables 8 to 11. Exponent of coefficients are presented as the relative risk of dying during infancy and childhood by children of various groups considered under the models.

The results of model 1 presented in Table 8 revealed that in the low mortality group, the relative risk of infant mortality was significantly high (about 28 per cent) among male children as compared to female children. No significant difference was observed in the relative risk of infant mortality between the male and female children in the high and medium mortality groups. There was no significant difference in the relative risk of infant mortality among the children of various religions in all mortality groups except for the medium mortality group where the relative risk of infant mortality was significantly less among the children of other religion as compared to Muslims.

The children of Scheduled Tribe in the high and low mortality groups and the children of other castes in the high and medium mortality groups have significantly lower risk of infant mortality than Scheduled Caste. Mother's standard of living has a significant effect on infant mortality only at higher level of standard of living in the high and medium mortality groups. The children of mothers from households of high standard of living in the high and low mortality groups have significantly less risk of infant mortality as compared to children of mothers with low standard of living. Education of mother has a significant effect on infant mortality only in the high and low mortality groups. The relative risk of infant mortality among the children of literate mothers was significantly less in the high and low mortality groups as compared to illiterates. In the medium mortality group, the effect of education on infant mortality was not significant. The effect of mother's education on infant and child mortality is evidenced from many studies conducted elsewhere in India. (Rao.S.R, Randey A, Shajy KI, 1997, Prakasam C.P., 1994, Prakasam.C.P Sinha UP; Srider VS,1991, Dasgupta M, 1990)

15

Covariates	Infant Mortality			Child Mortality		
	High	**Medium**	**Low**	**High**	**Medium**	**Low**
Sex of the Child						
Male	1.04	0.93	1.28***	0.76***	0.68***	0.81*
Mother's age at birth						
Age at birth	0.85***	0.86***	0.85***	1.04	0.96	1.05
Square term of age at birth	1.00***	1.00***	1.00***	1.00	1.00	1.00
Religion						
Hindu	1.06	0.96	1.09	1.01	0.76*	1.01
Others	0.92	0.70*	1.02	1.35	0.38***	1.40
Caste						
Schedule Tribe	0.84*	0.87	0.62***	0.99	1.39*	0.84
Others	0.88*	0.76***	0.86	0.86	0.99	0.91
Standard of Living Index(SLI)						
Medium SLI	0.94	0.92	0.83**	0.88	0.97	0.71**
High SLI	0.74*	0.98	0.67***	0.73	0.65	0.87
Mother's Education						
Literate	0.73***	0.96	0.77***	0.76**	0.76*	0.89

Table 8 Relative risk of sex of the child, mother's age at the time of child's birth, religion, caste, mother's standard of living and mother's education on infant and child mortality, estimated by using hazard model for four years period preceding the survey, Rural India, 1992-93

* P < 0.10   ** P <0.05   *** P < 0.01

Reference Category: Female Child; Muslims; Scheduled Caste; Low SLI; Illiterate mother.

The relative risk of selected socio-economic and demographic variables on child mortality (deaths among children age 1 - 4 years) also presented in Table 8, revealed that the relative risk of child mortality was significantly less among male children as compared to female children in all mortality groups. The relative risk of child mortality among male children was 24 percent less in high mortality group 32 per cent less in medium mortality group and 19 per cent less in low mortality group as compared to female children.

In the high and low mortality groups, there was no significant difference in the relative risk of child mortality between the children of different religions. However, in the medium mortality group, the relative risk was significantly less among the children of mothers belonging to Hindus and other religions as compared to Muslims. Children of Scheduled Tribe in the medium mortality group seemed to have a high risk of child mortality as compared to Scheduled Caste. Mother's standard of living did not make any significant effect on child mortality in high and medium

mortality groups. However, in the low mortality group, the relative risk of child mortality was significantly less (29 percent) among the children of mothers from the households of medium standard of living as compared to low standard of living. The relative risk of child mortality was significantly less (24 percent) among the children of literate mothers in both the high and medium mortality groups. However, the effect of education on child mortality was not significant in the low mortality group.

The results of the second model presented in Table 9 revealed that in the high mortality group, the relative risk of infant mortality was significantly less among the children of second(19 percent) and third order(26 percent) as compared to first order births. In the medium mortality group, the relative risk was significantly less by 15 percent among the children of second order births and in the low mortality group the risk was significantly high by 34 percent among the children of fifth order births as compared to first order births.

Birth order did not make any significant effect on child mortality in the medium and low mortality groups. However, in the high mortality group, the relative risk of child mortality was significantly high for third, fourth and fifth order births as compared to first order births. The introduction of birth order did not alter the effect of education on infant and child mortality as emerged in model - I.

Covariates	Infant Mortality			Child Mortality		
	High	Medium	Low	High	Medium	Low
Birth Order						
2	0.81***	0.85*	0.97	1.13	0.86	0.94
3	0.74***	0.91	1.09	1.39**	0.95	0.90
4	0.90	0.86	1.27	1.37*	0.77	1.32
5+	0.99	1.24	1.34*	1.35*	0.83	0.70
Mother's education						
Literate	0.69***	0.90	0.72***	0.73***	0.66***	0.86
Mother's age at birth						
Age at birth	0.87***	0.87***	0.83***	0.98	0.98	1.02
Square term of mother's age at birth	1.00***	1.00***	1.00***	1.00	1.00	1.00

Table 9   Relative risk of birth order, mother's age at birth and mother's education on infant and child mortality estimated by using hazard model for four years period preceding the survey, Rural India, 1992 - 93.

* P < 0.10   ** P < 0.05   *** P < 0.01
Reference Category : Birth order 1, illiterate mother

The results of model-3 presented in Table 10 revealed that the sex composition of older surviving siblings did not make any significant effect on infant mortality in all mortality groups. The effect of interaction between sex of the child and sex composition of older surviving siblings was significant in the medium and low mortality groups when the child was male with all older surviving siblings female as compared to male with all older surviving siblings mixed. The consideration of interaction in the model altered the significant effect of sex of the child and mothers education in the low mortality group as emerged in model-I. The significant effect of these variables as emerged in model-I has become non-significant in model-3 due to the interaction effect. In the medium mortality group, the significant effect of age at birth on infant mortality as emerged in model-1 become non-significant due to interaction effect.

Covariates	Infant Mortality			Child Mortality		
	High	Medium	Low	High	Medium	Low
Sex of the child	1.07	0.87	1.18	0.65***	0.62**	1.06
Male						
Mother's age at birth	0.86***	0.97	0.80***	0.91	0.93	0.94
Age at birth	1.00***	1.00	1.00**	1.00	1.00	1.00
Square term of age at birth						
Sex composition of older surviving siblings						
All siblings are brothers	1.13	0.88	0.81	0.84	0.76	0.90
All siblings are sisters	1.09	1.23	1.26	0.64**	0.84	1.70
Interaction terms between sex of the child and sex composition of older surviving siblings						
Male, all sib, are brothers	0.96	1.04	1.11	1.26	1.66	1.14
Male, all sib, are sisters	0.96	0.68*	0.89**	1.46	1.18	0.35
Mothers Education						
Literate	0.71***	0.89	0.73	0.59***	0.62	0.70

Table 10 **Relative risk of sex of the child and mother's age at birth, sex combination of older surviving siblings and interaction terms between sex of the child and sex composition of older surviving siblings and mother's education on infant and child mortality estimated by using hazard model for four years period preceding the survey, Rural India, 1992-93.**

Note : Model includes only births order of 3 and above
* P < 0.10   ** P < 0.05   *** P < 0.01
Reference Category: Female Child; Mixed siblings; Male, all siblings are mixed; illiterate mother.

The sex composition of older surviving siblings did not make any significant effect on child mortality in the medium and low mortality groups. However, in the high mortality group, the relative risk of child mortality was significantly less when all older surviving siblings were female as compared to mixed siblings. There was no significant effect of interaction between sex of the child and sex composition of older surviving siblings on child mortality in all mortality groups. Due to the introduction of sex composition variable, the significant effect of sex of the child on child mortality in the low mortality group and the significant effect of education of mother on child mortality in the medium mortality group as emerged in model-1 became non-significant in this model.

The results of model 4 presented in Table 11 revealed that the antenatal care during pregnancy did not make any significant effect on infant mortality in all mortality groups. Hospital delivery has a significant effect on infant mortality in the high and low mortality groups where as in the medium mortality group the effect was not significant. For hospital deliveries, while the relative risk of infant mortality was 20 per cent high in the high mortality group, it was 20 per cent less in the low mortality group as compared to home deliveries.

Immunisation during pregnancy has a significant effect on infant mortality in all mortality groups. The relative risk of infant mortality among the children of mothers who have received tetanus toxoid vaccination was as less as 27 per cent in the high mortality group whereas it was 18 per cent less in the medium mortality group and 30 per cent less in the low mortality group as compared to the children of mothers who have not received tetanus toxoid vaccine during pregnancy.

Maternal care variables did not show any significant effect on child mortality in all mortality groups except for antenatal care in the low mortality group. It is found that in the low mortality group, the relative risk of child mortality was significantly less among the children of mothers who have received antenatal care as compared to those who have not. In the medium mortality group, the significant effect of education on child mortality in the high mortality group as emerged in model-1 became non-significant in this model.

Covariates	Infant Mortality			Child Mortality		
	High	Medium	Low	High	Medium	Low
Antenatal Care (ANC)						
Availed	0.88	0.96	1.23	0.80	1.11	0.58*
Place of Delivery						
Hospital	1.20*	1.03	0.80**	0.81	0.89	0.86
Immunisation (T T)						
Availed	0.73**	0.82*	0.70**	0.93	0.96	1.52
Mother's Education						
Literate	0.80***	1.01	0.76***	0.85	0.70**	0.94

Table 11 Relative risk of Antenatal care (ANC), Tetanus Toxoid (TT) place of delivery and mother's education on infant and child mortality estimated by using hazard model for four years period preceding the Survey, Rural India, 1992 - 93.

*P < 0.10 **P < 0.05 ***P < 0.01

Reference Category : ANC not availed; other than hospital delivery;
T T not availed; illiterate mother

SUMMARY AND CONCLUSION

The findings of the study provide useful information to suggest viable strategies to reduce infant and child mortality in rural India.

The findings indicate vast variations in infant and child mortality rates among the three mortality groups. Though infant and child mortality rates have declined substantially in all mortality groups in the fifteen years period prior to survey (1978-92), the levels observed for the period 1988-92 indicate that both the rates were significantly higher among the children of high mortality group as compared to medium and low mortality groups. Comparatively poor housing conditions, high levels of fertility and under utilisation of maternal health care services by women in the high mortality group are the possible reasons for the high levels of infant and child mortality rates in the high mortality group. Hence, special efforts should be made to improve the housing conditions, reduce fertility (high risk pregnancies) and improve the availability, accessibility and quality of maternal health and family planning services in the high mortality group.

The impact of child survival programmes in India has resulted in the reduction of post neonatal mortality rather than neonatal mortality especially in rural India. It is evidenced from the results of the present study that neonatal mortality continues to be high and constitute more than 60 per cent of infant deaths in all mortality groups. Hence the child survival programme in India

should also focus on reducing neonatal mortality in rural India. The continuing higher proportion of neonatal deaths could be addressed by ensuring that women in emergencies of pregnancy and child birth are better access to obstetric care, complications of pregnancy are detected early and treated promptly on the spot or by referral to higher level and increasing the proportion of women attended in child birth by trained health personnel.

The significant associations of various demographic and maternal care variables with infant mortality observed in this study in all mortality groups suggest the need for high priority to implement reproductive health programmes more effectively and vigorously in rural India with special attention in the high mortality group of states. The priority reproductive health needs include antenatal care, medical attention at birth and family planning services. A significant proportion of women in rural areas particularly in the high mortality group are reluctant to use medical maternal care services. They prefer to give birth at home with the assistance of untrained personnel rather than an institutional delivery attended by trained health personnel. Hence, improving the availability and utilisation of maternal care services are needed particularly in the high mortality group of states.

The significant relationship of either religion or caste with infant mortality indicates the prevailing traditional and cultural practices of mothers in maternal and child care. Appropriate educational strategies are required to be integrated with the reproductive health programmes in order to remove wrong beliefs and ill practices prevailing in rural areas among different cultural groups. As infant and child mortality are associated with education, standard of living and employment status of women, special programmes aiming at improving the status of women through education and employment opportunities in rural areas are required to be implemented along with the reproductive health programmes.The significantly excess female child mortality observed in all mortality groups indicates the prevalence of sex bias in rural areas. Empowerment of women and integration of women into development process will help to remove such sex bias in the long run.

The results strongly suggest that the health care delivery system in India must be area specific. The persistence of high infant and child mortality rates observed among the high mortality group of states deserves special attention. Time specific, special child survival programmes as suggested above need to be implemented in the high mortality group of states in order to achieve the desired level of infant and child mortality rates at an early date for India.

Reference:

1. Dasgupta.M.(1990). Death clustering, mother's education and the determinants of Child mortality in rural Punjab, India. Population Studies Nov: 44(3): 489 – 505.

2. Human Development Report (2003).

3. Prakasam C.P. (1994). Factors affections child mortality in Bihar. In Population and Development in Bihar. Eds.U.P.Sinta and R.K.Sinta, B.R.Publishing Corporation, New Delhi.

4. Rao.SR.Pandey a.Shajy K.I.(1997). Child mortality in Goa: a cross-sectional analysis. Social Biology. Spring-summer: 44 (1-2): 101 – 10.

5. Registrar General of India (2001) Sample Registration Bulletin Vol.32 (2) Oct 2001.

6. Registrar General of India, 2004. Sample Registration Bulletin – Vol38.No.1

7. UNICEF (2001) Where under five die. Under five deaths by region, 2000.