

AN APPLICATION OF COX PROPORTIONAL HAZARD REGRESSION MODEL TO ASSESS THE PREDICTORS OF CHILD MORTALITY IN INDIA

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ABSTRACT

Background and Objective

The level of child mortality is more in India as compared to most of the other countries. This study examines the socio-economic and demographic characteristics associated with child mortality.

Methods

The present study utilizes data from the third round of the Demographic and Health Survey (DHS), known as the National Family Health Survey (NFHS), carried out in India during 2005–06 and were analyzed to assess the socio-economic and demographic factors associated with child mortality. The survey covers a representative sample of about 108504 ever-married women in the age group 15–49 who gave at least one live birth baby within 10 years preceding the survey. Univariate and multivariate Cox proportional hazard model along with complex sample analysis plan were used to understand the socio-economic and demographic factors associated with child mortality.

Result

Various socio-economic and demographic characteristics were found to be associated with child mortality. After controlling for other factors wealth index, caste, Birth order and birth interval were found to be significantly associated with child mortality. The hazard of child mortality was highest among ST (HR=2.157, CI=1.613-2.886, P value=0.000) as compared to other caste. Women having education high school and above were at 44.4% less risk (HR=0.556, CI=0.361-0.858) of child mortality as compared with illiterate women. The risk of facing child mortality is 2.66 times high in women with birth order 4 or more (HR=2.668, CI=1.984-3.588, P value=0.000) as compared to women with birth order one. Women with birth interval more than two years had 45.3% less risk (HR=0.547, CI=0.470-0.637, P value=0.000) of facing child mortality than those with birth interval less than two years. Male children were at 32.1% less hazard (HR=0.679, CI=0.588-0.783, P value=0.000) of child mortality as compared to female children.

Interpretation and Conclusions

Various socio-economic and demographic characteristics are found to be associated with child mortality. Findings support the need to focus on spacing between two births, age of mother at first birth, birth order and education of mother.

KEYWORDS: Socio-Economic, Demographic Factors, Child Mortality

INTRODUCTION

Child Mortality of a nation is a widely accepted and long standing well-being indicator of the children. Childhood mortality is one of the important indicators of a country's general medical and public health conditions, and

consequently, the country's level of socio-economic development. Its decline is therefore not only desirable but also indicative of an improvement in general living standards.

Child mortality is an appropriate indicator of the cumulative exposure to the risk of death between the ages one to four years of life, and an accepted global indicator of the health and socio-economic status of a given population. It is also useful for assessing the impact of various intervention programs aimed at improving child survival.

The International Conference on Primary Health Care held in Alma Ata in 1978 was the first global forum to consider how child mortality could be reduced by systematic development of a primary health care system. Since then, the United Nations has been actively involved in reducing IMR and U5MR in developing countries. To this end, the plan of action adopted at the International Conference on Population and Development (ICPD) held in Cairo in 1994 incorporates the reduction of maternal and child mortality.

In India, during 1968–70, the level of IMR was stable at 130 deaths per 1000 live-births. Following the Alma Ata declaration of 1978, the Government of India envisaged a national goal for the attainment of an IMR of 60 by the year 2000. Since then, substantial resources have been put into the child survival programmes over the past 25 years. The Sixth and Seventh Five-Year Plans had aimed at nationwide programmes to realize this goal. The twenty-point Programme included, as a key component, rapid improvement in the conditions of women and children. In 1979, the Expanded Programme of Immunization (EPI) was established to provide the tetanus toxoid (TT) vaccine to pregnant women, and BCG, DPT, polio and measles vaccine to children. The Universal Immunization Programme (UIP) and oral rehydration therapy (ORT) were both launched in 1985 and the Safe Motherhood Programme initiated during the Eighth Plan was among the prominent components of the Family Welfare Programme. In the early 1990s, these programmes were integrated and further strengthened to shape the Child Survival and Safe Motherhood (CSSM) Programme. In 1994, the CSSM Programme was further expanded to the Reproductive and Child Health (RCH) services. These programmes had the desired effect of reducing child mortality and improving child health as evidenced from the child mortality statistics of 1978–2002. The National Population Policy (2000) and National Health Policy (2002) addressed the issues of child survival and maternal health, and increased the outreach and coverage of the comprehensive package of RCH services through the government as well as the voluntary non-government sector together in partnership.

In order to reduce child mortality, the Government of India launched an ambitious National Rural Health Mission (NRHM) in April 2005, where the Child Health Program (CHP) comprehensively integrated interventions that improve child health and address factors contributing to infant and under-five mortality¹. The major components of CHP are – the establishment of Newborn Care facilities and Facility Based Integrated Management of Neonatal and Childhood Illnesses (FIMNCI); Navjaat Shishu Suraksha Karyakram; Integrated Management of Neonatal and Childhood Illnesses (IMNCI) and Pre- Service IMNCI; home based care of newborns, universal immunization, early detection and appropriate management of Acute Respiratory Infections (ARI), diarrhea and other infections coupled with other supplementation and school health programs. However, the main barrier to extensive coverage of integrated packages for health of mothers, neonates and children in most countries including India² is inadequate operational management, especially at the district level³.

India has the world's highest percentage (21%) of under-five deaths, estimated at 1726000 in 2009. The country managed to reduce the under-five mortality rate (U5MR) from 118 per 1000 live births in 1990 to 66 per 1000 live births in 2009. The average annual rate of decline at 3.1% was considered insufficient to achieve Millennium Development Goal

(MDG) 4 that targets minimizing under-five mortality to 39 per 1000 live births by 2015⁴. The north-south variation in child mortality in India is reflected in literature⁵⁻⁶ where some of the north Indian states such as Rajasthan, Uttar Pradesh, Bihar, Orissa, Chhattisgarh and Madhya Pradesh persistently performed poorly in health care⁷. On account of the unacceptably high fertility and mortality indicators, the eight Empowered Action Group (EAG) states (Bihar, Chhattisgarh, Jharkhand, Madhya Pradesh, Orissa, Rajasthan, Uttarakhand, Uttar Pradesh and Assam), which account for about 48% of India's population, are designated as "High Focus States" by the Government of India. The U5MR in Uttar Pradesh (94 per 1000 live births), Madhya Pradesh (89 per 1000 live births), Orissa (82 per 1000 live births), Assam and Bihar (77 and 78 per 1000 live births) are almost similar to the U5MR in some African countries – Djibouti (94 per 1000 live births), Zimbabwe (90 per 1000 live births), Kenya (84 per 1000 live births), Sao Tome and Principe (78 per 1000 live births) respectively⁸.

OBJECTIVE

To Study the Pattern and Predictors of Child mortality

LITERATURE REVIEW

Being a large country, India is very diverse in its socioeconomic and demographic characteristics. Most of the southern states, including Goa and Maharashtra, are on track to achieve MDG 4 within the stipulated time, whereas child health⁹⁻¹⁰. The education of the mother, age at birth, nutritional status, attendance at childbirth and spacing between childbirths are important covariates responsible for these interstate differentials¹⁰⁻¹². In addition, the coverage gap in essential child health services and newborn care provided in primary health Centre has been found to transpire as the other significant correlate of under 5 mortality in India.

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Evidence also shows alarming disparities in fewer than five mortality rates within countries. A child's the northern and other socioeconomically disadvantaged states record poor risk of dying before age five increases if she or he is born in a remote rural area, into a poor household or to a mother with no education.¹³

India is home to the largest proportion of underweight children in the world and there is a high prevalence of

neonatal, infant and child mortality.¹⁴⁻¹⁵The likely explanations include social inequities, disparities in health systems between diverse groups of population, and the impact of unplanned urbanization and demographic transition.¹⁶⁻¹⁸The education of the mother, age at birth, nutritional status, attendance at childbirth and spacing between childbirths are important covariates responsible for these interstate differentials.¹⁸⁻²⁰Studies have revealed that the poor economic condition of the household, parent's illiteracy and caste are major contributors to health inequalities among children in Indian states.¹⁶⁻¹⁷

DATA AND METHODOLOGY

The present study utilizes data from the third round of the Demographic and Health Survey (DHS), known as the National Family Health Survey (NFHS), carried out in India during 2005–06. The NFHS is a large-scale, multi-round survey conducted in a representative sample of households covering more than 99% of the population throughout India. The third wave of NFHS (NFHS-3), conducted in 2005–06, is the outcome of the collaborative efforts of many organizations such as the International Institute for Population Sciences (IIPS), United States Agency for International Development (USAID), Department for International Development (DFID), United Nations Children's Fund (UNICEF) and United Nations Population Fund (UNFPA). Within each state, a two-stage stratified random sampling design was adopted in rural areas wherein first villages then households were selected for the survey. In urban areas, a three-stage random sampling design was employed with the selection of cities/ towns followed by urban blocks and then households. The survey intended to obtain reliable estimates of the parameters of interest at various level of aggregation (states, urban/rural metropolitan cities), so target sample sizes were determined based on the lowest level of aggregation at which estimates were desired. The survey covers a representative sample of about 108504 ever-married women in the age group 15–49 who gave at least one live birth baby within 10 years preceding the survey.

Dependent variable in this study is child mortality. Child Mortality measures the probability of dying between the age of one and four years (expressed per 1000 live births).

Important socioeconomic and demographic predictors included in the analysis were:

- Age of women (15-19, 20-24 and 25–49 years)
- Education of women (illiterate, literate but below primary, primary but below middle, middle but below high school and high school and above)
- Place of residence (rural and urban)
- Child Sex (Female and Male)
- Mass media exposure (no exposure and any exposure)
- Wealth quintile (poorest, poorer, middle, richer and richest)
- Religion (Hindu, Muslim and others)
- Caste (Scheduled Caste (SC), Scheduled Tribe (ST), Other Backward Class (OBC) and others)
- Birth order (1,2-3 and 4 or more)
- Birth Interval (less than 2 years and greater than 2 years).

- Parity (1-2, 3-4 and ≥ 5)
- Working status of women (Not working, working at home and working away from home)
- Women Empowerment (Not empowered, Partially empowered and Fully empowered)
- Region [North (Delhi, Haryana, Himachal Pradesh, Rajasthan, Punjab, Jammu & Kashmir and Uttaranchal), Central (Chhattisgarh, Madhya Pradesh, Uttar Pradesh), East (Bihar, West Bengal, Jharkhand and Orissa), North-East (Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim and Tripura), West (Goa, Gujarat and Maharashtra) and South (Andhra Pradesh, Karnataka, Kerala and Tamil Nadu)].

A relative index of household wealth was calculated from a standard set of assets owned by the household, including ownership of consumer items and dwelling characteristics. The NFHS-3 wealth index is based on the following 33 assets and housing characteristics: household electrification; type of windows; drinking water source; type of toilet facility; type of flooring; material of exterior walls; type of roofing; cooking fuel; house ownership; number of household members per sleeping room; ownership of a bank or post-office account; and ownership of a mattress, a pressure cooker, a chair, a cot/bed, a table, an electric fan, a radio/transistor, a black and white television, a color television, a sewing machine, a mobile telephone, any other telephone, a computer, a refrigerator, a watch or clock, a bicycle, a motorcycle or scooter, an animal-drawn cart, a car, a water pump, a thresher, and a tractor.

Individuals were ranked on the basis of their household score and divided into quintiles, each representing 20% of the score, between 1 (poorest) and 5 (richest) (IIPS & Macro International, 2007). The mass media exposure is formed by considering how often the respondents read the newspaper, listen to the radio and watch television or cinema.

Woman empowerment was made by combining three variables.

- Participation in decision making (It is made by combination of participation in decision making of own health care, large household purchases, household purchase for daily needs and visiting to relative or family) If in decision making there is no role of respondent then it is said as not empowered and value given is 1, if in decision making there is partial role of respondent then it is said as partially empowered and value given is 2 whereas if the decision is taken by respondents alone then it is said as fully empowered and value given is 3.
- Access to money (If in access to money there is no role of respondent then it is said as not empowered and value given is 1, if in access to money there is partial role of respondent then it is said as partially empowered and value given is 2 whereas if the decision of where to spend the money is taken by respondents alone then it is said as fully empowered and value given is 3.)
- Freedom for movement (It is made by combination of allowance to go to market, health facilities and places outside the village/communities) If there is no allowance to go to any place then it is said as not empowered and value given is 1, if there is allowance to go but only with someone else then it is said as partially empowered and value given is 2 whereas if there is allowance to go alone to all places then it is said as fully empowered and value given is 3.

After that women empowerment is made by adding the values of these three variables. Now the women empowerment is coded as follows:

- Not empowered- 3 to 4
- Partially empowered- 5 to 6
- Fully empowered- 7 to 9

Statistical analysis: Univariate and multivariate Cox proportional hazard model along with complex sample analysis plan was used to examine effects of socio-economic and demographic factors on risk of child mortality.

For this model, we defined dependent variable as time (age of the child) and survival status of child (1 if event has occurred *i.e.* child died and 0 if child is alive) during period of child (1 - 4 year). Results of the multivariate analysis are presented as hazard ratios (risk of dying). If hazard ratio is > 1 for a predictor variable, it means that the hazard is higher, *i.e.* increased risk of death and if hazard ratio is < 1 , it implies a decreased risk of death. Cox proportional hazard analysis was based on pooled data of 108504 births in the ten years preceding date of survey for child mortality.

The whole analysis, graphs and Maps were made in SPSS version 20.0, Stata version 13, R version 3.2.0, R-Studio, Diva-GIS and Q-GIS.

The Following Survival Curves Represent Survival of Childs with Respect to different Background Characteristics (Covariates) of Mothers

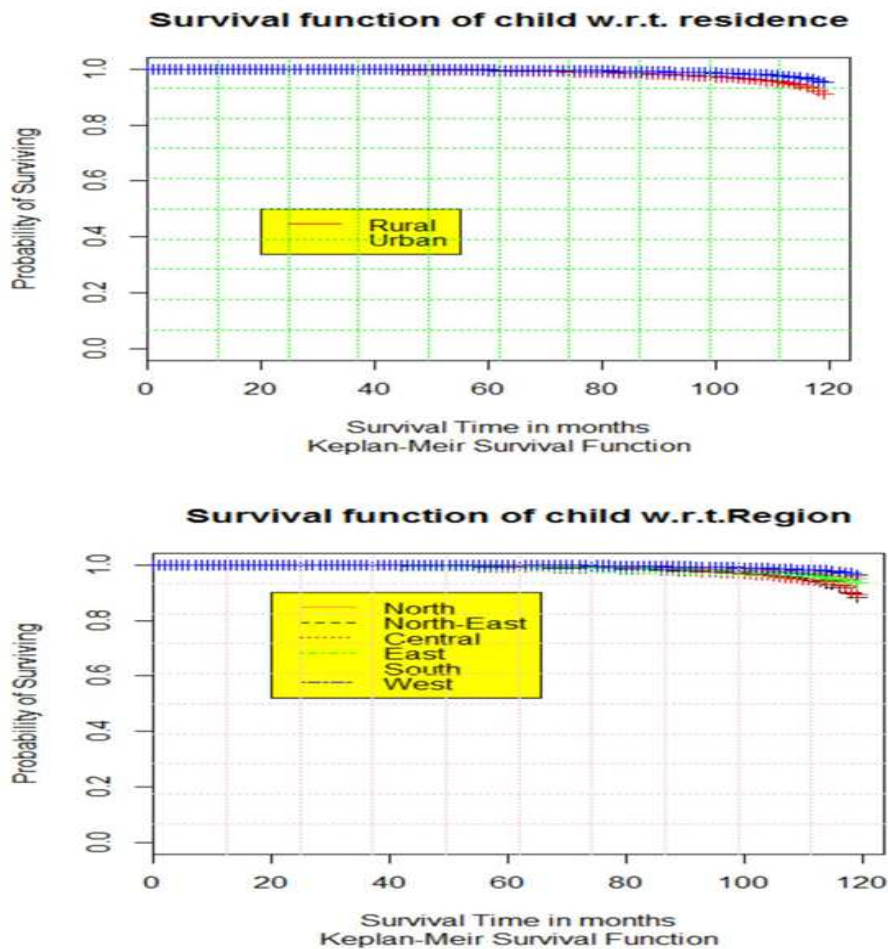


Figure 1

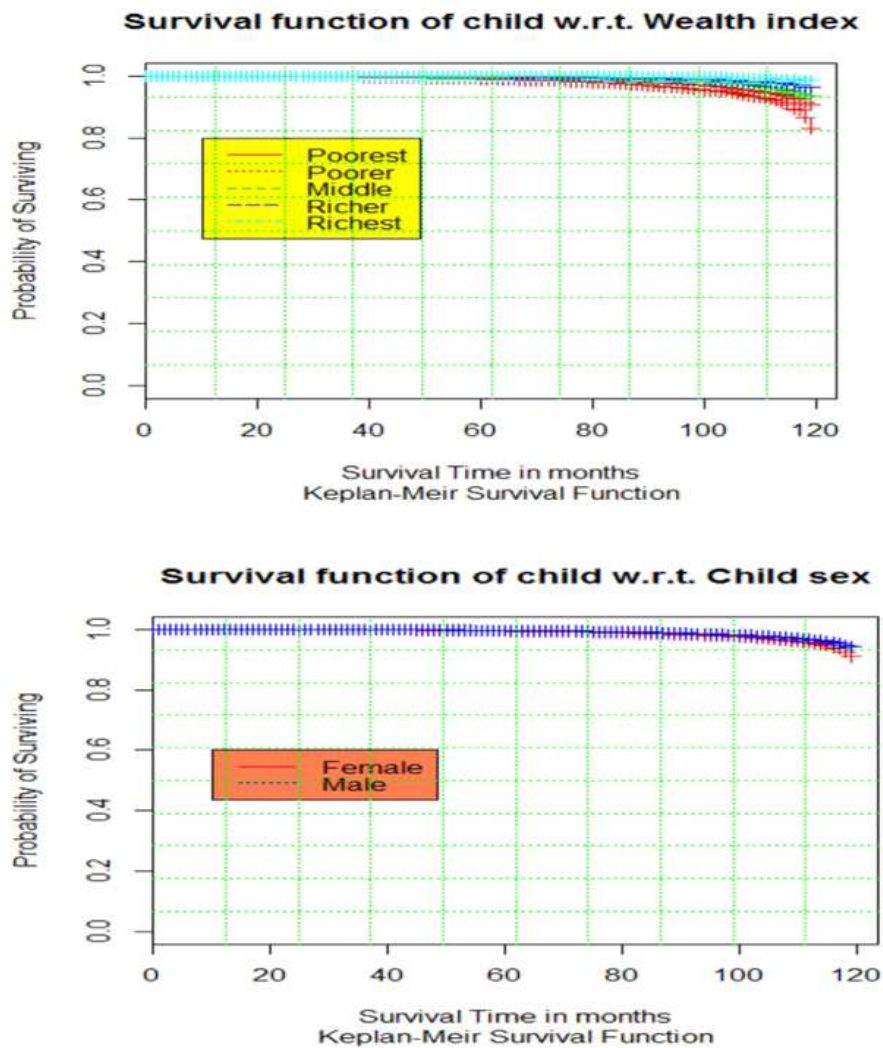


Figure 2

Table 1a: Frequency and Percentage Distribution of Background and Demographic Characteristics NFHS-3(2005-06), India

Background Characteristics	Unweighted Sample	Weighted Sample	Weighted Percent	95% C.I.	
				Lower	Upper
Age of Mother at Birth					
Less than 20	17916	22995	19.3	18.8	19.8
20-24	41941	47230	39.5	39.0	40.0
25 -49	48647	49224	41.2	40.5	41.9
Type of Residence					
Rural	67534	89165	74.6	73.1	76.2
Urban	40970	30284	25.4	23.8	26.9
Education of Mother					
Illiterate	49634	65905	55.2	53.8	56.5
Literate but below Primary	8536	8522	7.1	6.8	7.5
Primary but not Middle	15652	15984	13.4	12.9	13.9
Middle but below High School	13763	12415	10.4	9.9	10.9
High School and above	20919	16624	13.9	13.2	14.6
Religion					
Hindu	75192	93657	78.4	76.7	80.0
Muslim	17936	20170	16.9	15.3	18.6

Others	15376	5623	4.7	4.2	5.2
Caste					
Others	31486	31105	26.8	25.5	28.3
SC	19275	24347	21.1	19.9	22.1
ST	17443	11733	10.1	9.1	11.2
OBC	35689	48673	42.0	40.4	43.6
Wealth Index					
Poorest	20067	31343	26.2	25.0	27.5
Poorer	20426	27176	22.8	22.0	23.6
Middle	22414	23497	19.7	18.9	20.4
Richer	23411	20942	17.5	16.7	18.3
Richest	22186	16490	13.8	13.0	14.7
Child's Sex					
Female	52310	57591	48.2	47.8	48.6
Male	56194	61858	51.8	51.4	52.2
Region					
North	19703	15564	13.0	11.7	14.5
Central	24886	35850	30.0	27.7	32.4
East	16834	29260	24.5	22.2	27.0
North-East	19965	4567	3.8	3.2	4.6
West	11649	15010	12.6	11.1	14.1
South	15467	19198	16.1	14.7	17.6

Table 1b: Frequency and Percentage Distribution of Background and Demographic Characteristics NFHS-3(2005-06), India

Background Characteristics	Unweighted Sample	Weighted Sample	Weighted Percent	95% C.I.	
				Lower	Upper
Birth Order					
1	33225	34372	28.8	28.3	29.3
2-3	47431	51151	42.8	42.3	43.3
4 or More	27848	33925	28.4	27.5	29.3
Birth Interval					
Less than 2 Years	60436	65804	55.1	54.7	55.5
Greater Than 2 Years	48067	53645	44.9	44.5	45.3
Parity					
<=2	41828	42236	35.4	34.4	36.3
3 to 4	40066	43928	36.8	36.1	37.5
5 and above	26610	33285	27.9	26.8	28.9
Women Empowerment					
Not empowered	14818	20597	17.2	16.5	18.0
Partially Empowered	79348	84312	70.6	69.8	71.4
Fully Empowered	14338	14540	12.2	11.6	12.7
Working Status					
Not working	63170	66964	56.1	54.8	57.4
At Home	9401	9826	8.2	7.6	8.9
Away from home	35933	42659	35.7	34.4	37.1
Mass Media Exposure					
No Exposure	27869	40396	33.8	32.5	35.2
Any Exposure	80635	79053	66.2	64.8	67.5

Table 2a: Bivariate Analysis of Background and Demographic Characteristics with Child Mortality Rate .NFHS-3(2005-06), India

Background Characteristics	CMR	
	Alive	Dead
Age of Mother		
Less than 20	98.5	1.5
20-24	98.9	1.1
25 -49	98.5	1.5
	$\chi^2= 36.504$,P-value=0.000	
Type of Residence		
Rural	98.5	1.5
Urban	99.2	0.8
	$\chi^2= 86.032$,P-value=0.000	
Education of Mother		
Illiterate	98.1	1.9
Literate but below Primary	99.0	1.0
Primary but not Middle	99.2	0.8
Middle but below High School	99.6	0.4
High School and above	99.7	0.3
	$\chi^2= 425.065$,P-value=0.000	
Religion		
Hindu	98.7	1.3
Muslim	98.7	1.3
Others	99.0	1.0
	$\chi^2= 5.434$,P-value=0.220	
Caste		
Others	99.2	0.8
SC	98.3	1.7
ST	97.5	2.5
OBC	98.8	1.2
	$\chi^2= 193.377$,P-value=0.000	
Wealth Index		
Poorest	97.7	2.3
Poorer	98.4	1.6
Middle	99.0	1.0
Richer	99.4	0.6
Richest	99.7	0.3
	$\chi^2= 433.519$,P-value=0.000	
Child's Sex		
Female	98.4	1.6
Male	98.9	1.1
	$\chi^2= 60.493$,P-value=0.000	

Table 2b: Bivariate Analysis of Background and Demographic Characteristics with Child Mortality Rate .NFHS-3(2005-06), India

Background Characteristics	CMR	
	Alive	Dead
Region		
North	98.8	1.2
Central	98.2	1.8
East	98.4	1.6
North-East	98.7	1.3
West	99.3	0.7
South	99.4	0.6
	$\chi^2= 195.310$,P-value=0.000	
Birth Order		
1	99.2	0.8
2-3	98.9	1.1
4 or More	97.8	2.2
	$\chi^2= 255.437$,P-value=0.000	
Birth Interval		
Less than 2 Years	98.5	1.5
Greater Than 2 Years	99.0	1.0
	$\chi^2= 53.197$,P-value=0.000	
Parity		
<=2	99.6	0.4
3 to 4	98.9	1.1
5 and above	97.3	2.7
	$\chi^2= 709.938$,P-value=0.000	
Women Empowerment		
Not empowered	98.7	1.3
Partially Empowered	98.7	1.3
Fully Empowered	98.4	1.6
	$\chi^2= 8.198$,P-value=0.115	
Working Status		
Not working	98.9	1.1
At Home	98.8	1.2
Away from home	98.3	1.7
	$\chi^2= 83.050$,P-value=0.000	
Mass Media Exposure		
No Exposure	97.9	2.1
Any Exposure	99.1	0.9
	$\chi^2= 230.244$,P-value=0.000	

Table 3a: Cox Regression Model Showing Unadjusted Hazards Ratio and Confidence intervals Offacing Child Mortality among Women who had at Least One Live Birth in Their Age (15-49 Years) During the Last Ten Years Preceding the Survey, NFHS-3 (2005-06), India

Background Characteristics	Unadjusted Hazards Ratio	P Value	95% C.I.	
			Lower	Upper
Age of Mother at Birth				
Less than 20	1.0			
20-24	0.844	0.098	0.6903	1.0319
25 -49	1.130	0.195	0.9390	1.3605
Type of Residence				
Rural	1.0			
Urban	0.5005	0.000	0.4106	0.6102

Education of Mother				
Illiterate	1.0			
Literate but below Primary	0.5393	0.000	0.3949	0.7363
Primary but not Middle	0.4603	0.000	0.3581	0.5916
Middle but below High School	0.2500	0.000	0.1712	0.3650
High School and above	0.1720	0.000	0.1160	0.2552
Religion				
Hindu	1.0			
Muslim	0.9748	0.818	0.7848	1.2109
Others	0.7059	0.027	0.5183	0.9613
Caste				
Others	1.0			
SC	2.1701	0.000	1.6878	2.7902
ST	3.1289	0.000	2.3966	4.0851
OBC	1.5591	0.000	1.2250	1.9844
Wealth Index				
Poorest	1.0			
Poorer	0.7235	0.001	0.6005	0.8718
Middle	0.4330	0.000	0.3487	0.5377
Richer	0.2712	0.000	0.2090	0.3518
Richest	0.1399	0.000	0.0977	0.2006
Child's Sex				
Female	1.0			
Male	0.6806	0.000	0.5921	0.7822
Region				
North	1.0			
Central	1.6407	0.000	1.2824	2.0992
East	1.4467	0.008	1.1027	1.8978
North-East	1.1534	0.402	0.8257	1.6112
West	0.5982	0.005	0.4187	0.8548
South	0.5026	0.000	0.3574	0.7069

Table 3b: Cox Regression Model Showing Unadjusted Hazards Ratio and Confidence Intervals Offacing Child Mortality among Women who had at Least One Live Birth in Their Age (15-49 Years) During the Last Ten Years Preceding the Survey, Nfhs-3 (2005-06), India

Background Characteristics	Unadjusted Hazards Ratio	P Value	95% C.I.	
			Lower	Upper
Birth Order				
1	1.0			
2-3	1.4342	0.000	1.1892	1.7296
4 or More	2.5469	0.000	2.1030	3.0841
Birth Interval				
Less than 2 Years	1.0			
Greater Than 2 Years	0.7392	0.000	0.6450	0.8472
Parity				
<=2	1.0			
3 to 4	1.5129	0.001	1.1864	1.9292
5 and above	3.0471	0.000	2.4306	3.8201
Women Empowerment				
Not Empowered	1.0			
Partially Empowered	0.7607	0.007	0.6232	0.9285
Fully Empowered	0.7471	0.022	0.5818	0.9593
Working Status				
Not working	1.0			

Working At Home	0.8537	0.305	0.6311	1.1549
Work away from Home	1.2264	0.010	1.0493	1.4334
Mass Media Exposure				
No Exposure	1.0			
Any Exposure	0.489	0.000	0.4212	0.5679

Table 4a: Cox Regression Model Showing Adjusted Hazards Ratio and Confidence Intervals Offacing Child Mortality among Women who had at Least One Live Birth in Their Age (15-49 years) during the Last Ten Years Preceding the Survey, NFHS-3 (2005-06), India

Background Characteristics	Adjusted Hazards Ratio	P Value	95% C.I.	
			Lower	Upper
Age of Mother at Birth				
Less than 20	1.0			
20-24	0.7936	0.042	0.6350	0.9917
25 -49	0.8287	0.144	0.6440	1.0663
Type of Residence				
Rural	1.0			
Urban	1.0509	0.654	0.8457	1.3060
Education of Mother				
Illiterate	1.0			
Literate but below Primary	0.7901	0.180	0.5599	1.1146
Primary but not Middle	0.8380	0.220	0.6318	1.1115
Middle but below High School	0.5282	0.003	0.3451	0.8085
High School and above	0.5568	0.008	0.3613	0.8581
Religion				
Hindu	1.0			
Muslim	0.9980	0.988	0.7806	1.2761
Others	0.9214	0.606	0.6752	1.2573
Caste				
Others	1.0			
SC	1.6177	0.000	1.2497	2.0941
ST	2.1577	0.000	1.6134	2.8858
OBC	1.2714	0.057	0.9924	1.6287
Wealth Index				
Poorest	1.0			
Poorer	0.8586	0.133	0.7037	1.0476
Middle	0.6200	0.000	0.4883	0.7872
Richer	0.4897	0.000	0.3591	0.6678
Richest	0.3587	0.000	0.2345	0.5485
Child's Sex				
Female	1.0			
Male	0.6793	0.000	0.5887	0.7838
Region				
North	1.0			
Central	1.2387	0.089	0.9681	1.5850
East	1.1625	0.278	0.8857	1.5258
North-East	1.0714	0.693	0.7607	1.5089
West	0.7146	0.052	0.5091	1.0029
South	0.6053	0.005	0.4252	0.8616

Table 4b: Cox Regression Model Showing Adjusted Hazards Ratio and Confidence Intervals Offacing Child Mortality among Women who had at least one Live Birth in Their Age (15-49 years) DURING the Last Ten Years Preceding the Survey, NFHS-3 (2005-06), India

Background Characteristics	Adjusted Hazards Ratio	P Value	95% C.I.	
			Lower	Upper
Birth Order				
1	1			
2-3	2.0120	0.000	1.6233	2.4937
4 or More	2.6687	0.000	1.9846	3.5885
Birth Interval				
Less than 2 Years	1.0			
Greater Than 2 Years	0.5473	0.000	0.4702	0.6370
Parity				
<=2	1.0			
3 to 4	0.7534	0.041	0.5741	0.9888
5 and above	0.8391	0.260	0.6183	1.1387
Woman Empowerment				
Not Empowered	1.0			
Partially Empowered	0.7481	0.004	0.6139	0.9117
Fully Empowered	0.8096	0.116	0.6222	1.0535
Working Status				
Not Working	1.0			
Working at home	0.7349	0.058	0.5344	1.0104
Working away from home	0.8116	0.023	0.6775	0.9721
Mass Media Exposure				
No Exposure	1.0			
Any Exposure	0.8818	0.140	0.7462	1.0420

INTERPRETATION

TABLE 1 depicts the percentage and frequency distribution of the respondent’s background and Demographic characteristics which includes their age, place of residence,

Region, mother’s education, religion, caste, previous birth interval, birth order, gender of child, Parity, Wealth index, Working status, Women empowerment and mass media exposure

Among all mother’s 41.2% were aged between 25- 49 and 39.5% were aged between 20-24 years at the time of survey. Around 30% of the respondent belongs to central region and around one fourth to east region. Around 75% of the respondent belongs to rural areas, and 55% had no formal education. About 78% of the respondents were Hindus. About 55% of the respondents have a birth interval of less than 2 year. Around 28% of the respondents have parity of 5 and above whereas around 37% has a parity of 3-4. Among all the respondents 42% were OBC, 19% were SC and 17% were ST. Among the respondents 42.8% have birth order 2 or three. Among all the babies born within ten years preceding the survey 51.8% was male. Around 70% of the respondents were partially empowered whereas 66.2% have any exposure of media. Around half of the respondents have wealth index below average (i.e. they belong to poorest or poorer wealth index class) and 56.1% were not working.

TABLE 2 depicts chi square and significant (p- values) values of all the background and demographic

characteristic with respect to child mortality in order to check the existence of any sort of association between the two, considering level of significance as 5%.

Thus, we may conclude from table 2 that, although woman empowerment and religion has no association with child mortality but background characteristics like Mother's age, mother's education level, parent's residence, caste, region, parent's wealth index, birth interval, birth order, gender of child, parity, Mass Media Exposure and working status has association with child mortality.

TABLE 3 depicts results of the survival analysis using Cox regression model(unadjusted) reiterate that Urban women, compared with their Rural counterparts, had 50% less risk of facing child mortality (HR=0.500, CI=0.411-0.610, P value=0.000). As expected, child mortality decreases with the women's educational level. Compared with illiterate women, those with education high school and above had 83% less risk of facing child mortality (HR=0.172, CI=0.116-0.255, P value=0.000). The risk of facing child mortality was found to be 2.17 times higher in SC (HR=2.1701, CI=1.688-2.790, P value=0.00) and 3.13 times higher in ST (HR=3.128, CI=2.397-4.085, P value=0.00) as compared with others caste taken as reference. Result showed that the women belonging to south region had 50 % less hazard of child mortality and women belonging to central region had 64% more hazard of child mortality than those women belonging to north India.

Women who had any exposure to mass media had 51% less risk of facing child mortality (HR=0.489, CI=0.421-0.568, P value=0.000) than women who had no mass media exposure. Result shows that women working away from home had 22 % more hazard of child mortality (HR=1.226, CI=1.049-1.433, P value=0.010) than women not working. Women with birth interval more than two years had 26% less risk (HR=0.739, CI=0.645-0.847, P value=0.00) of child mortality than those women with birth interval less than two years. The hazard of child mortality is 2.546 times more in women having birth order 4 or more (HR = 2.546, CI=2.103-3.084,P value= 0.000) and 1.43 times more in women having birth order 2-3 (HR=1.434, CI = 1.189-1.729, P Value=0.000) as compared to women having birth order 1 . The risk of facing child mortality is low in women delivering male child (HR=0.680, CI=0.592-0.782, P value=0.000) compared to women who delivered female child. The risk of facing child mortality in mother belonging to richest wealth quintile is 86% lower (HR=0.139, CI=0.097-0.200, P value=0.000) than mother belonging to poorest wealth quintile. The hazard of child mortality is 3.05 times more in women having parity 5 and above(HR=3.047,CI=2.431-3.820,P Value=0.000) and 1.51 times more in women having parity 3 to 4 (HR=1.513, CI=1.186-1.929, P Value= 0.001) as compared to women having parity less than 3. Women having full empowerment have 16% less risk (HR=0.747, CI=0.581-0.959, P Value=0.022) of facing child mortality than women having no empowerment.

TABLE 4 depicts results of the survival analysis using Cox regression model (adjusted i.e. controlling other background and demographic factors) reiterate that as expected, child mortality decreases with the women's educational level. Compared with illiterate women, those with education high school and above had 44% less risk of facing child mortality (HR=0.5568, CI=0.361-0.858, P value=0.008). The risk of facing child mortality was found to be 61.7% higher in SC (HR=1.617, CI=1.249-2.094, P value=0.000) and 2.16 times higher in ST (HR=2.157, CI=1.613-2.886, P value=0.000) as compared with other castes.

Among women respondents surveyed, women with age 20-24 had 20.7% less risk of facing child mortality (HR=0.793, CI=0.635-0.991, P value=0.042) than women having age less than 20 years. Women with birth interval more than two years had 45.3% less risk (HR=0.547, CI=0.470-0.637, P value=0.000) than those with birth interval less than two years. The risk of facing child mortality is 2.66 times high in women with birth order 4 or more (HR=2.668, CI=1.984-

3.588, P value=0.00) as compared to women with birth order one. The risk of facing child mortality is 32.1% less in women delivering male child (HR=0.679, CI=0.588-0.783, P value=0.000) as compared to women who delivered a female child. The risk of facing child mortality in mother belonging to southern region is 39.5% low (HR=0.605, CI=0.425-0.861, P value=0.005) as compared to women belonging to north region. The risk of facing child mortality in mother belonging to richest wealth quintile is 64.2 % lower (HR=0.358, CI=0.234-0.548, P value=0.000) than mother belonging to poorest wealth quintile.

DISCUSSIONS & CONCLUSIONS

The present analysis has primarily examined the levels and trends of child mortality in India.

Birth order and preceding birth interval of the child are known to be significantly associated with mortality²¹. Increasing birth order was found to be positively associated with child mortality²². Studies have indicated an adverse association between the length of the preceding birth interval and child survival²³⁻²⁵. Mortality tends to increase with the birth order. The steady increase in child mortality with the birth order may reflect competition in economically disadvantaged population²⁶. This study supports the previous finding which states that increasing birth order is positively associated and increase in birth interval is negatively associated with child mortality.

The results depicted an increasing risk of child mortality with low and high Mother's age at birth. So, there is a U-shaped relationship observed between mother's age at child birth and child mortality. Similar findings have been observed in general population^{22,28-29}. Increasing impact of low age of mother at birth on mortality could be due to wide gap in utilization of the mother and child health (MCH) care services between younger and older mothers. There is a need for programmes to focus on delaying the age at first birth for younger women. Such efforts would not only reduce the child mortality but also help in reducing the morbidity conditions in children under five^{27,30-31}.

This study showed a higher risk of child mortality among female as compared to male child. Similar findings have been observed in general population and are consistent with other studies^{32,33}. Biologically a male child is at higher risk of mortality. However, the socio-behavioral causes such as gender based discrimination may in part attribute for the higher mortality of a female child.

Our findings showed a positive association of education with child survival i.e. with increase in education level of mother risk of facing child mortality decreases. Education heightens a mother's ability to make use of government and private health care resources and it may increase the autonomy necessary to advocate for her child in the household and the outside world. Some studies, however, indicate that the causal relationship is not clear, but rather that mother's education is often just a good indicator of other socio-economic factors that affect under-five mortality³⁴⁻³⁵. The children of educated mothers have a greater chance of survival, in part because educated women seek out higher quality services and have a greater ability to use healthcare inputs³⁶⁻³⁷.

A considerable poor-rich gap in mortality has emerged from this study. Woman belonging to richest wealth index is less likely to face child mortality as compared with woman belonging to poorest wealth index. Several studies have reiterated the case of economic inequality and health care access leading threat to the newborns at early age³⁸.

Further, the study reconfirmed the regional differences in mortality indicators highlighted by several studies³⁹. Also, our findings show that there is association between caste and child mortality.

The ongoing national programmes on decreasing infant and child mortality have been focusing on educating women on increasing age at marriage, age at first birth and increasing the birth interval between two births.

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