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Original Research Article

Predictors of Neonatal and Infant Deaths in India

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ABSTRACT

Background: Child mortality is one of the important indicators that reflect level of socio-economic development and existence and utilization of medical services of any nation. Decline of child mortality, especially during neonate and infancy period is highly desirable. Many programmes launched by the country; still child mortality is of major concern. Further, effective implementation of modified programs is the need to reduce IMR for which modifiable determinants of mortality during neonatal period and infancy are needed.
Aim: Assessing the status and determinants of neonatal and infant mortality
Method: Present analysis was carried on data of NFHS-3 conducted in 2005-06. Bivariate analysis was used to identify the associated characteristics and Logistic Regression analysis to eliminate the effect of confounding was followed to identify the determinants of IMR. Statistical significance was judged at 5% level of significance.
Result: A wide regional gap was found for both neonatal and IMR; lowest in western and southern regions (3.2%) and highest in central region (6.6%) but the proportion of neonatal to infant deaths was almost similar and was around 70% in all the regions except north-east. Education, income, age and parity had much role to play to neonatal and infant mortalities. The risk of death during infancy was higher by 1.28, 1.23, 1.76 and 1.32 times higher in north, north-east, central and east compared to southern region. Higher was the education of mother, lower was the neonatal and infant deaths irrespective of region.
Conclusion: Women should be advised to avoid pregnancy before age 20 years, maintain adequate spacing, and not to move to higher order births for which needed contraceptive methods should be suggested to practice. Also, regional variation in services to reduce low birth weight babies should be on priority for maximum IMR reduction.

Keywords: Birth Order, Infant, Neonatal, Mortality.

INTRODUCTION

Child mortality is one of the important indicators that reflect level of socio-economic development and existence and utilization of medical services of any nation. Decline of child mortality is, therefore, highly desirable to bring the substantial improvement in general living conditions of the society and accordingly scientists struggled to identify the underlying causes for its reduction. As per the WHO classification of 14 sub regions,

India falls within South East Region D (SEAR-D) which is characterized as a "high mortality region". This region has experienced a moderate reduction in child mortality during last 5 decades. Currently, in all countries of this region (Nepal, Bangladesh and Sri-Lanka) child mortality is lower than that of India. Of the 9.7 million child deaths worldwide annually, one-third (2.5 million) occur in India; the highest number in quantity compared to any country [1] and 2.1 million die before their fifth birthday out of which half die during neonatal period. In India the infant and under five mortalities is in the ratio of 9:1 that indicates concentrated effort is needed to substantial reduction of infant mortality rate (IMR). The reduction in IMR can be achieved to maximum extent, if neonatal deaths are considerably reduced as out of total infant deaths, two third are during neonatal period. Many have studied and addressed the challenges for neonatal mortality and determined the predictors of infant mortality in a developing country; [2,3] the cited reasons of high IMR are inadequate neonatal care, insufficient breastfeeding, under-nutrition, poor immunity level, high incidence of infectious (communicable) diseases compounded with unmet health need. The low birth weight irrespective of reason is the major cause of deaths during infancy. Of the 19 million low birth weight (LBW) born in the developing world approximately 43% are in India [4] MDG 4 called for achieving a two third reduction in the mortality of child aged less than 5 years of age between 1990 and 2015. Life expectancy at birth is grossly affecting IMR; it is also useful for assessing the impact of various interventions aimed at improving child survival. This scenario had forced the international organizations as well as National Governments in India to intensify their efforts to reduce infant mortality that resulted to considerable improvements from 80to 37 between 1990 and 2016. [5] The role of programmes launched though, with various names time to time such as EPI, UIP, CSSM and RCH by making additions of services extended to reduce child mortality was commendable.

MATERIALS AND METHODS

The present analysis was carried on data of NFHS-3 conducted in 2005-06. [6] Out of total 51555 born, only 50072 born from beginning of March 2001 to February 2006 were considered. Further, 949 born were also excluded as these were incomplete for certain characteristics under consideration. Thus, the analysis was confined only to 49123 born. The categories of various characteristics of mother and children considered were: Region(North, North-East, Central, East, West and South), Mother's age in years(Below 20, 20-30 and 30-49), Place of residence(urban and rural), Mother's Education(no education, primary, secondary and higher education), Religion(Hindu, Muslim, Christian, Sikh and others), Wealth index (Poorest, Poorer, Middle, Richer and Richest), Parity (First, Second & third, Fourth & fifth, and Sixth or above), Sex of child(Male and Female), Birth type(Multiple and Single), Place of delivery (Home and Institutional), Size of child at birth (Very large, Larger than average, Average, Smaller than average and Very small). Initially, the background characteristics of mother and children were presented in percentages. The association of IMR with the mother and children characteristics was tested first with bivariate analysis and finally logistic regression was carried by including only those found significantly associated in bivariate analysis. In logistic regression though all the characteristics were considered, but results are presented only for those found significantly associated at 5% level of significance.

RESULTS

Table-1: Percent of infant deaths and ratio of neonatal deaths to infant deaths by the back ground characteristics of mothers and born

Characteristics	No.	% of Infant deaths	χ2, df, p value	Ratio of neonatal deaths to infant deaths	χ2, df, p value
Region					
North	8946	4.5	161.22, 5, <0.001	0.68	12.91, 5, 0.024
North-East	8885	4.2		0.60	
Central	11372	6.6		0.68	
East	7708	5.4		0.70	
West	5308	3.2		0.73	
South	6904	3.3		0.68	
Place of residence					
Urban	18628	3.8	55.92, 1, <0.001	0.68	0.03, 1, 0.867
Rural	30495	5.3		0.67	
Religion					
Hindu	34046	5.0	16.11, 4, 0.003	0.69	20.66, 4, <0.001
Muslim	8200	4.6		0.68	
Christian	4691	3.8		0.53	
Sikh	845	4.4		0.73	
Others	1341	4.1		0.60	
Sex of child					
Male	25561	4.8	0.91, 1, 0.339	0.70	8.60, 1, 0.003
Female	23562	4.7		0.65	
Education of mother					
No education	20026	6.3	256.83, 4, <0.001	0.64	14.47, 2, 0.002
Primary	7079	5.4		0.68	
Secondary	18248	3.4		0.73	
Higher	3770	1.7		0.70	
Age of mother					
Below 20	2454	7.6	48.38, 2, <0.001	0.70	7.49, 2, 0.024
20-30	32891	4.7		0.69	
30-49	13778	4.4		0.63	
Parity					
First	15753	4.9	83.74, 3, <0.001	0.74	26.71, 3, <0.001
Second & third	21694	4.0		0.66	
Fourth & fifth	7679	5.5		0.62	
Sixth or above	3997	7.0		0.62	
Wealth index					
Poorest	8730	6.5	237.08, 4, <0.001	0.69	13.24, 4, 0.010
Poorer	9062	6.5		0.62	
Middle	10089	4.9		0.66	
Richer	10818	3.9		0.70	
Richest	10424	2.6		0.73	
Place of delivery					
Home	26930	5.6	84.31, 1, <0.001	0.63	30.67, 1, <0.001
Institutional	22193	3.8		0.75	
Size of child at birth					
Very large	1862	4.9	316.21, 4, <0.001	0.72	10.03, 4, 0.040
Larger than average	9350	3.9		0.70	
Average	27877	4.1		0.64	
Smaller than average	7034	5.7		0.69	
Very small	3000	11.0		0.72	
Birth type					
Multiple	762	22.2	519.42, 1, <0.001	0.76	6.91, 1, 0.009
Single	48361	4.5		0.67	

**percent of infant deaths, **ratio of neonatal deaths to infant deaths*

As indicated in Table-1, IMR had shown significant differential ($p < 0.001$); lowest was in western and southern regions (3.2%) and highest in central region (6.6%) but the proportion of neonatal deaths to infant deaths was almost similar around 70% in all the regions except the lowest in north-east (60%). Although, IMR was significantly higher among rural, but no difference was for neonatal deaths. Associations of infant and neonatal deaths with the religion were strong; infant death was lowest among Christian while the IMR was the highest in Hindus and neonatal deaths among Sikh. In both the sexes of the child, infant deaths were almost similar but neonatal deaths were significantly higher among male born. As the education of

mothers was increasing, the decreasing trend of IMR was quite substantial from 6.3% in mothers of no education to 1.7% in higher education; but visa vase proportion of neonatal deaths was decreasing significantly with rising level of education. In mothers of age group below 20 years, IMR was as high as 7.6% and almost similar around 4.5% in the age groups 20-30 and 30-49 years; while proportion of neonatal deaths was similar around 70% in the age groups below 20 and 20-30 years; but much low (63%) in mothers of age group 30-49. Order of birth also showed highly significant association with infant as well as neonatal deaths; infant deaths was the highest among women moving to 6th& higher order; while neonatal death was highest amongst the first order. The IMR was significantly decreasing as one move from poorest to richest (p <0.001); highest (6.5%) among the poorest and the lowest (2.6%) among the richest; while neonatal death was the lower among poorer and middle wealth index group. Compared to institutional deliveries, IMR was significantly high amongst home deliveries and converse was the neonatal mortality (P < 0.001). Among home deliveries, IMR was about 1.5 times than the institutional deliveries. As reported by mothers about the size of the child at birth among those born very small, the infant death was almost double than any category of the size of child at birth. Though, statistical association between the neonatal death and size of the child at birth was evidenced, but differences were slighter. Obviously, in those of multiple births, both infant deaths as well as neonatal deaths were higher compared to those giving single birth.

Table-2: Characteristics affecting deaths of born during neonate period in India: Result of Logistic Regression Analysis

Characteristics	β	Wald Value	P value	Odds Ratio	95% CI
Male	0.25	7.45	0.006	1.28	1.07-1.53
Female	Ref.	---	---	---	---
Place of delivery					
Home	-0.42	13.23	0.000	0.66	0.52-0.82
Institutional	Ref.	---	---	---	---
Birth type					
Multiple	0.57	8.52	0.004	1.77	1.21-2.59
Single	Ref.	---	---	---	---

Table-2 indicates the determinants of neonatal deaths obtained through logistic regression; out of eleven characteristics none except sex of child, twins and place of delivery were found statistically associated. Compared to female born, the risk of death to male born was 1.28 (95% CI: 1.07 – 1.53) higher. The risk of death during neonate period was also higher by 1.77 (95% CI: 1.07 – 1.53) times if the born were twins; while lesser by 34% in home delivered child than institutional.

Table-3 indicates the determinants of IMR obtained through logistic regression; out of eleven characteristics considered as shown in Table-2, place of residence, religion, sex of child and place of delivery did not emerge as the significant determinants to IMR. Compared to the born of Southern region, the risk of death during infancy was significantly higher by 1.28 (95% CI: 1.07 – 1.53), 1.23 (95%CI: 1.01 – 1.49). 1.76(95%CI: 1.50 – 2.08) and 1.32(95%CI: 1.11 – 1.58) times in North, North-East, Central and East respectively; while almost similar in western region (highest in central region). Considering age of mother and comparing with mothers of age 30-49, risk of infant death was high in born to mothers of ages <20 years. The risk of death of born was increasing as educational level of mother was decreasing and was 2.56 times (95% CI: 1.91-3.42) higher in those with no education compared to higher level of education. Similar increasing risk of infant deaths was observed as wealth index was decreasing. Compared to the born of Para 6th and above, the risk of infant death was almost same in Para first, while significantly reduced in

Para 2 to 5. Obviously very high risk of infant death was among those with multiple births (OR = 6.09; 95% CI: 5.05-7.33) compared to singleton births. Compared with a child of very small size at birth, risk of death during infancy was 0.52(95%CI: 0.41-0.67), 0.39(95%, CI: 0.33-0.46), 0.39(95%, CI: 0.35-0.45) and 0.49(95%CI: 0.42-0.58) times lesser among born of size very large, larger than average, average, smaller than average respectively.

Table-3: Characteristics affecting deaths of born during infancy period in India: Result of Logistic Regression Analysis

Characteristics	β	Wald Value	P value	Odds Ratio	95% CI
Region					
North	0.25	7.57	0.006	1.28	1.07 – 1.53
North-East	0.20	4.31	0.038	1.23	1.01 – 1.49
Central	0.57	45.84	0.<0.001	1.76	1.50 – 2.08
East	0.28	10.01	0.002	1.32	1.11 – 1.58
West	0.02	.04	0.851	1.02	0.83 – 1.25
South	Ref.	---	---	---	---
Education of mother					
No education	0.94	40.06	0.<0.001	2.555	1.91 – 3.42
Primary	0.87	32.97	0.<0.001	2.381	1.77 – 3.20
Secondary	0.56	15.97	0.<0.001	1.749	1.33 – 2.30
Higher	Ref.	---	---	---	---
Age of mother					
Below 20	0.42	16.15	0.<0.001	1.518	1.24 – 1.86
20-30	0.16	6.90	0.009	1.175	1.04 – 1.33
30-49	Ref.	---	---	---	---
Parity					
First	-0.04	0.19	0.660	0.959	0.79 – 1.16
Second & third	-0.37	17.74	0.<0.001	0.691	0.58 – 0.82
Furth & fifth	-0.22	6.37	0.012	0.806	0.68 – 0.95
Sixth or above	Ref.	---	---	---	---
Wealth index					
Poorest	0.41	15.40	0.<0.001	1.507	1.23 – 1.85
Poorer	0.50	25.91	0.<0.001	1.646	1.36 – 1.99
Middle	0.31	11.28	0.001	1.363	1.14 – 1.63
Richer	0.19	4.83	0.028	1.209	1.02 – 1.43
Richest	Ref.	---	---	---	---
Size of child at birth					
Very large	-0.64	26.667	0.<0.001	0.526	0.41 – 0.67
Larger than average	-0.94	134.254	0.<0.001	0.390	0.33 – 0.46
Average	-0.93	189.213	0.<0.001	0.394	0.35 – 0.45
Smaller than average	-0.71	79.620	0.<0.001	0.492	0.42 – 0.58
Very small	Ref.	---	---	---	---
Birth type					
Multiple	1.81	363.11	0.<0.001	6.085	5.05 – 7.33
Single	Ref.	---	---	---	---

DISCUSSION

Child mortality and child survival is a sensitive indicator of country's socio-economic development. Improving child survival, therefore, is a major development task. [7] As per MDG-4, India with very high IMR (80/1000 live births during nineties) had to reduce it to the level of 27 by the year 2015. [8] Continued efforts, though made by government of India to strengthen ANC program to reduce IMR but the achievement of goal remained far away from the target and by the end of 2016 it was 36/1000 live births. [9] Hence, to accelerate the reduction in IMR and neonatal deaths, identification of key determinants of child survival to make the appropriate policy is crucial. In India it can be seen that the slow improvements can be largely explained by specific social, economic, demographic and environmental factors; but strong persistent and significant impact of maternal education on child survival is one of the most striking which is interrelated with social, economic, demographic and environmental factors. An educated mother is likely to provide better nourishment and health care to a born as compared to an illiterate mother. Regional variations are apparent; especially for neonatal mortality that has direct impact to IMR; the lowest was in North-East region

(60% of infant deaths) as compared to 70% in other regions. In the age group of mothers above 30 years, the proportion of neonatal mortality was 63% while around 70% in both age groups below 30 years which is perhaps having more neonatal deaths on parity one. A child is likely to have more survival during infancy if the age of mother is above 20 years. So even if a woman is married below 20 years, she should be made aware of family planning programmes to delay the pregnancy. As parity was increasing proportion of neonatal deaths to total deaths during infancy was decreasing from 74% among parity one to 62% among fourth and above; perhaps mothers were well convergent with nursing of the child. While identifying the determinants of infant mortality rate, it was seen that place of residence, religion, sex of child and place of delivery did not emerge as the significant determinants. The regional differentials were seen; compared to the born of southern region, the risk of death during infancy was highest in central region 1.76 (95% CI: 1.50 – 2.08) and lowest in North-East 1.23 (95% CI: 1.01 – 1.49); which could be only because of variation of utilizing child care services. Considering age of mother and comparing with mothers of age 30-49, risk of death was high in those born to mothers of ages below 20; these births are actually in low class society considered as premature for giving births and of poor nutritional status resulting to more low weight born. The risk of death of born was increasing as educational level of mother was decreasing and was 2.56 times (95% CI: 1.91-3.42) higher in those with no education compared to higher level of education; but the country will be requiring longer time when all females will be literate; though being on the top priority in India to educate all. Similar increasing risk of infant deaths was observed as wealth index was decreasing; further, it is a long term goal and cannot be improved quickly. Compared to the born of Para 6^{th} and above, the risk of infant death was almost same in Para first, while significantly reduced in Para 2 to 5; hence mothers need to be advised not to give higher order births. Higher order births have many other consequential effects such as population increase, educational facilities to children, health of both mother and child etc. Compared with a child of very small size at birth, risk of death during infancy was 0.52 (95% CI: 0.41-0.67), 0.39 (95% CI: 0.33 – 0.46), 0.39 (95% CI: 0.35-0.45) and 0.49 (95% CI: 0.42-0.58) times lesser among born of size very large, larger than average, average, smaller than average respectively. In India, India, with nearly 7.5 million born are of low birth weight and more than 80% of total neonatal deaths occur among LBW/preterm neonates. [10, 11] This problem of low birth weight size can be reduced markedly by availing the antenatal care services and maintaining the adequate spacing between the births.

CONCLUSION

Mothers should be advised not to give birth before age 20 years, maintain adequate spacing, and not to proceed for higher births for which need based contraception be suggested to practice. Also, Regional variation in services to reduce low birth weight babies should be on priority for maximum IMR reduction.

REFERENCES

1. State of the world's children, New York, United Nations Children's fund 2000.
2. Blencowe H. and Cousens S. Addressing the challenge of neonatal mortality. Tropical medicine and international health. 2013; 18(3):303-12.
3. Uddin, M. J. andHossain. M. Z.Predictors of infant mortality in a developing country. Asian journal of Epidemiology.2008; 1(1):1-16.
4. Sharma, Suresh."Child Health and Nutritional Status of Children: The Role of Sex Differentials", Working Paper Series No.e/262/2005. Institute of Economic Growth, Delhi, India, 2005.
5. Office of Registrar, General of India, Government of India, (www.censusindia.gov.in)
6. National Family and Health Survey (NFHS-III) 2005-06, India, Vol.-I, Ministry of

Health and family Welfare, India. nfhsindia.org
7. Monitoring the situation of children and women. UNICEF Data 2018; data.unicef.org/topic/child-survival
8. Assembly UG. United Nations millennium declaration. United Nations General Assembly. 2000 Sep 8.
9. Sample Registration System Bulletin (SRS), Government of India, 2017.
10. Skjaerven R, Gjessing HK, Bakketeig LS. Birth weight by gestational age in Norway. *ActaObstetGynecolScand.*2000; 79: 440–49.
11. Ehrenkranz RA. Estimated foetal weights versus birth weights: should the reference intrauterine growth curves based on birth weights be retired? *Arch Dis Child Fetal Neonatal Ed* 2007; 92: F161–62.

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