International Journal of Health Sciences and Research
www.ijhsr.org ISSN: 2249-9571

Original Research Article

Differential and Determinants of Neonatal and Postnatal Mortality in India

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Received: 28/06/2016 *Revised: 20/07/2016* *Accepted: 25/07/2016*

ABSTRACT

Introduction: Fourth MGD goal was framed to focus on reduction of Child Mortality. India achieved much reduction but could not achieve the fixed target of 27. High IMR is due to high neonatal deaths; about two third of total infant deaths. For quick reduction in IMR, determinants of neonatal and postnatal deaths need to be focussed separately.
Objectives: To assess the differential pattern of neonatal and postnatal mortality and to identify and compare the determinants of these mortalities
Data & Methodology: Data of NFHS-3 was used. Of 51555 born births history and mortality was recorded; 2876 deaths were under five and 2508 were infant deaths. Ratio of neonatal and postnatal mortality was 2.2:1. Variation of neonatal and postnatal mortality was analysed by bivariate and logistic regression.
Observations & Results: Place of residence and religion did not contribute either neonatal or postnatal mortalities. The risks of neonatal mortality was 1.89, 1.41 and 1.32 times higher in Central, East and North regions compared to south; while postnatal mortality was higher by 1.46 times in Central region only. The risks of neonatal mortality among mothers age below 20 and 20-40 years were 1.47 and 1.18 times higher; while postnatal mortality 1.50 times higher among below 20 years only. Compared to mother's education higher secondary or above, the risks of neonatal mortality was 2.53 times in mothers either with no education or primary and 1.90 times higher in secondary level while risks of postnatal mortality were 2.57 and 2.20 times higher in no education and primary mothers respectively. The risk of neonatal mortality was highest among born to poorest families compared to richest families. The risks of neonatal mortality to born of 2^{nd} or 3^{rd} order and 4^{th} to 5^{th} were lesser by 30% and 22% compared to born of 6^{th} order; while 1^{st} order born had almost same risk while risk of postnatal mortality was lesser by 29% only in born of 2^{nd} or 3^{rd} order. Neonatal mortality of male children was 1.17 times higher than female, but postnatal mortality was almost similar. The size of child at birth had influence to both neonatal as well as postnatal mortalities. The risk of neonatal mortality was almost similar in children delivered at home or institution, but postnatal mortality was 1.37 times higher among children delivered at home.
Conclusion: The findings suggest that rising marriage age, limited births through promoting family planning devices and MCH care can bring a quick reduction to both neonatal and post natal mortality and thereby in IMR and the target fixed can be achieved well in time.

Key words: Mortality, Neonatal, Postnatal, Parity.

INTRODUCTION

Infant mortality rate (IMR) and under-five mortality rate (U5MR) are considered as sensitive indicators of living and socioeconomic conditions of a country and treated as children's well-being. This

has forced the international organizations as well as National Governments to intensify their efforts to reduce infant mortality and improve child survival. As a result, considerable improvements were recorded in the infant and child mortality rates in the world as a whole. India evidences child health inequalities because of huge differentials across socio-economic class, access and utilization of health services and moreover, awareness among the people. To achieve the goal of 60 infant deaths per 1000 live births by the year 2000, Government of India had focussed on universal immunization vaccination programme of BCG, DPT, polio and measles and care of children during the episodes of diarrhoea and pneumonia. The Millennium Development Goals (MDGs) with eight goals address the world's major development challenges with health and its related areas as the prime focus. The fourth goal of MGD was to focus on reduction of Child Mortality being a major issue for any nation. [1] Donors & Development agencies, United Nations and National Governments around the world committed themselves to the goal of reducing the under-five mortality rates by two-thirds by 2015 (UN Millennium Declaration). In India IMR during nineties was 80 per 1,000 live births and was major contributor to child mortality that reduced by half i.e. 40 per 1,000 live births by 2013. [2] Still high IMR is contributed by two third of neonatal deaths of the total infant deaths.

Since 1991 to 2013 encouraging improvement in IMR resulted (reduced from 80 to about 40 per 1000 live births) though the target of 27 fixed by the year 2015 could not be achieved. [2-5] In 2013, neonatal mortality rate was 28 ranging from 15 in urban areas to 31 in rural areas and was contributing 68% of the total infant death. [6] In only six major states e.g. Odisha, Uttar Pradesh (UP), Bihar, West Bengal, Rajasthan and Madhya Pradesh (MP) that constitute nearly half (45.4%) of the country population, neonatal mortality rate was very high ranging from lowest in West Bengal (21) to highest in Odisha (37) and MP (36) as against only 6 in Kerala. [7] Undoubtedly, for further quick reduction in IMR, neonatal deaths need to be focussed. [8,9] Neonatal and postnatal mortalities are sensitive indicator of health not only for children but also to mothers and economic development as these increasing rates of illness and putting pressure on health care delivery system. And the continued reproduction process to replace the loss of child increases the economic loss involved during pre and post natal care. The target of IMR fixed till 2015 could not be achieved; this would be possible when neonatal mortality will be reduced that will obviously will impact on postnatal mortality. To fulfill the target, policy makers always need pockets with high IMR separated by neonatal and postnatal mortalities and the underlying factors to influence so as need based feasible and cost effective programs be formulated and implement to achieve the maximum reduction. Hence, to focus the effort to reduce IMR quickly, it is pertinent to identify the influencing factors of neonatal and postnatal mortality separately. The Third National Family Health Survey (NFHS-3) provides nationwide data covering exhaustive number of characteristics, therefore, the present analysis taken up to identify the influencing factors that affect neonatal and postnatal mortality will be beneficial to the policy makers. The objectives, therefore, considered are as:

1. To assess the differential pattern of neonatal and postnatal mortality
2. To identify and compare the determinants of neonatal and postnatal mortality

The Data

Third NFHS-3 conducted in 2005-06 was coordinated by the International Institute for Population Sciences (IIPS) under the aegis of the Government of India. Unlike the earlier NFHS-1 (1992-93) and NFHS-2 (1998-99) surveys; NFHS-3 interviewed men age 15-54 and never married women age 15-49, as well as ever-

married women, and included questions on several emerging issues such as peri-natal mortality, male involvement in maternal health care, adolescent reproductive health, high-risk sexual behaviour, family life education, safe injections, and knowledge about tuberculosis. In addition for the first time in India, NFHS-3 carried out blood testing for HIV to provide population-based data on HIV prevalence. Data collected was a national representative sample of 109,041 households, 124,385 women age 15-49, and 74,369 men age 15-54. The births history and mortality was recorded for the last five years; a total of 51555 were born and 2876 were dead during childhood out of which 2508 were infant deaths with neonatal and postnatal mortality ratio 2.2:1.

Statistical Analysis

The analysis was carried using SPSS version 15.0. Initially, variation in neonatal and postnatal mortality was viewed according to demographic characteristics such as mother's age, birth order, child sex; socio economic characteristics such as religion, caste, mother's education, wealth index and child birth place as well as geographical location and cultural setting such as place of residence and region of birth place. The reason behind to include region of child birth is to adjust the estimates for regional variation. [10] Finally, logistic regression analysis was carried to identify the real contribution of the characteristics by isolating the confounding effects.

OBSERVATIONS & RESULTS

Table-1: Socio-demographic characteristics of mothers and children (N=51555)

Characteristics	No.	%	Characteristics	No.	%
Age group (Years)			**Birth Order**		
Below 20	2677	5.2	1st	16567	32.1
20 - 30	34495	66.9	2nd or 3rd	22727	44.1
30 - 49	14383	27.9	4th or 5th	8055	15.6
Region			6th or higher	4206	8.2
North	9286	18.0	**Multiple or single birth**		
North-East	9655	18.7	Multiple	805	1.6
Central	11659	22.6	Single	50750	98.4
East	8126	15.8	**Sex of child**		
West	5597	10.9	Male	26799	52.0
South	7232	14.0	Female	24756	48.0
Place of Residence			**Child size at birth**		
Urban	19483	37.8	Very large	1916	3.7
Rural	32072	62.2	Larger than average	9617	18.7
Education			Average	28733	55.7
No education	21057	40.8	Smaller than average	7277	14.1
Primary	7476	14.5	Very small	3103	6.0
Secondary	19102	37.1	Not Known	823	1.6
Higher Secondary or above	3919	7.6	Not recorded	86	0.2
Not Recorded	1	0.0	**Place of delivery**		
Religion			Home	28324	54.9
Hindu	35499	68.9	Institutional	23160	44.9
Muslim	8595	16.7	Not recorded	71	0.2
Christian	5064	9.8	**Status of Child**		
Sikh	884	1.7	Neo-natal death	1726	3.3
Others	1460	2.8	Post natal death	782	1.5
Not Recorded	53	0.1	Surviving beyond a year	49047	94.4
Wealth Index					
Poorest	9200	17.8			
Poorer	9571	18.6			
Middle	10659	20.7	**Ratio of neonatal deaths to postnatal**		2.2:1
Richer	11300	21.9			
Richest	10825	21.0			

As indicated in Table-1, about two third mothers (66.9%) were in most fertile age group 20-30 years and 27.9% above age 30 years; rest were of adolescent age. Highest mothers, nearly one fifth mothers (22.6%) were of central region with overall urban rural ratio 1:2. About two fifth (40.8%) mothers were illiterate and only

7.6% were higher secondary or above. More than two third mothers (68.9%) were Hindus and 16.7% Muslims and rest either Christian or Sikh or others like Jain or Buddhist. Nearly two fifth mothers (36.4%) belonged to poorer or poorest wealth index and 32.9% richer or richest wealth index. Second or third order children were highest (44.1%) while rest 55.1% children were of high risk parity i.e. either first or fourth & above. More than half (52.0%) children were male. Smaller than average or very small size births were nearly 20% and less than half of the births (44.9%) were institutional. About five percent (4.8%) were infant deaths of which 3.3% were contributed by neonatal deaths.

Table 2: Per 1000 survival status of children as per background characteristics

Characteristics	No. of children	Child Status			P value
		Neonatal mortality	Postnatal mortality	Surviving beyond a year	
Age of mother(years)					
< 20	2677	56.8	20.9	922	
20 - 30	34495	33.7	14.4	952	0.000
30 - 49	14383	26.6	15.9	955	
Region of birth					
North	9286	31.3	13.7	955	
North-East	9655	26.3	16.4	957	
Central	11659	45.5	21.0	934	0.000
East	8126	40.1	16.0	944	
West	5597	26.4	8.9	965	
South	7232	24.5	10.0	966	
Place of residence					
Urban	19483	27.5	12.3	960	0.000
Rural	32072	37.1	16.9	946	
Education of mother					
No education	21057	46.4	21.9	932	
Primary	7476	38.8	17.1	944	0.000
Secondary	19102	25.6	9.1	964	
Higher secondary or above	3919	13.0	4.8	982	
Religion					
Hindu	35499	36.1	15.0	949	
Muslim	8595	30.8	14.5	855	
Christian	5064	21.7	16.8	961	0.000
Sikh	884	32.8	11.3	956	
Others	1460	27.4	17.8	955	
Wealth index					
Poorest	9200	46.5	19.9	934	
Poorer	9571	41.3	23.6	935	
Middle	10659	34.1	15.9	950	0.000
Richer	11300	28.4	11.2	960	
Richest	10530	20.9	7.2	972	
Birth order					
1st	16567	28.3	12.6	959	
2nd or 3rd	22727	27.2	13.3	959	0.000
4th or 5th	8055	34.0	20.4	946	
6th or higher	4206	53.7	25.4	941	
Single or multiple Birth					
Multiple	805	172.7	49.7	778	0.000
Single	50750	31.3	14.6	954	
Sex of child					
Male	26799	35.7	14.2	950	0.000
Female	24756	31.1	16.2	953	
Child size at birth					
Very large	1916	35.0	13.0	952	
Larger than average	9617	27.2	11.4	961	
Average	28733	26.5	14.2	959	0.000
Smaller than average	7277	39.2	17.5	943	
Very small	3103	79.0	29.6	891	
Can't say	823	85.1	9.7	905	
Place of delivery					
Home	28324	35.7	19.6	948	0.000
Institution	23160	29.4	9.2	961	

Table 3: Characteristics associated with postnatal deaths with reference to survival beyond one year: Logistic regression analysis

Characteristics	Neonatal Mortality			Post Natal Mortality		
	Odds ratio	P value	95% CI	Odds ratio	P value	95% CI
Age group (Years)						
Below 20	1.47	0.002	1.16 - 1.86	1.50	0.023	1.06 - 2.13
20 - 30	1.18	0.024	1.02 - 1.37	1.11	0.308	0.91 - 1.35
30 - 49	Ref.	-	-	-	-	-
Region						
North	1.32	0.010	1.07 - 1.63	1.10	0.551	0.81 - 1.50
North-East	1.22	0.084	0.97 - 1.54	1.09	0.630	0.78 - 1.51
Central	1.89	0.000	1.56 - 2.29	1.46	0.010	1.10 - 1.93
East	1.41	0.001	1.15 - 1.72	1.06	0.713	0.78 - 1.44
West	1.10	0.458	0.86 - 1.39	0.81	0.262	0.55 - 1.18
South	Ref.	-	-	-	-	-
Place of residence						
Urban	1.00	0.957	0.88 - 1.14	1.20	0.057	0.99 - 1.44
Rural	Ref.	-	-	-	-	-
Education						
No education	2.53	0.000	1.80 - 3.56	2.57	0.000	1.52 - 4.36
Primary	2.53	0.000	1.79 - 3.58	2.20	0.004	1.28 - 3.76
Secondary	1.90	0.000	1.38 - 2.62	1.47	0.136	0.89 - 2.43
Higher secondary or more	Ref.	-	-	-	-	-
Religion						
Hindu	1.23	0.271	0.85 - 1.76	0.81	0.358	0.53 - 1.27
Muslim	1.03	0.894	0.70 - 1.50	0.66	0.080	0.41 - 1.05
Christian	0.96	0.836	0.64 - 1.43	1.05	0.835	0.65 - 1.69
Sikh	1.31	0.335	0.76 - 2.25	0.84	0.663	0.38 - 1.85
Others	Ref.	-	-	-	-	-
Wealth index						
Poorest	1.64	0.000	1.29 - 2.08	1.31	0.148	0.91 - 1.89
Poorer	1.56	0.000	1.25 - 1.96	1.76	0.001	1.25 - 2.47
Middle	1.37	0.003	1.11 - 1.69	1.40	0.045	1.01 - 1.93
Richer	1.24	0.030	1.02 - 1.51	1.17	0.328	0.86 - 1.60
Richest	Ref.	-	-	-	-	-
Birth order						
1st	1.08	0.530	0.86 - 1.35	0.77	0.096	0.56 - 1.05
2nd or 3rd	0.70	0.001	0.56 - 0.86	0.71	0.016	0.54 - 0.94
4th or 5th	0.78	0.019	0.63 - 0.96	0.85	0.236	0.66 - 1.11
6th or higher	Ref.	-	-	-	-	-
Single or multiple birth						
Multiple	6.87	0.000	5.59 - 8.44	4.28	0.000	3.04 - 6.02
Single	Ref.	-	-	-	-	-
Sex of child						
Male	1.17	0.002	1.06 - 1.30	0.91	0.198	0.79 - 1.05
Female	Ref.	-	-	-	-	-
Child size at birth						
Very large	0.54	0.000	0.41 - 0.71	0.49	0.002	0.31 - 0.77
Larger than average	0.39	0.000	0.32 - 0.47	0.42	0.000	0.31 - 0.55
Average	0.36	0.000	0.31 - 0.42	0.48	0.000	0.38 - 0.61
Smaller than average	0.48	0.000	0.40 - 0.57	0.55	0.000	0.41 - 0.72
Very small	Ref.	-	-	-	-	-
Place of delivery						
Home	0.89	0.068	0.78 - 1.00	1.37	0.001	1.13 - 1.67
Institution	Ref.	-	-	-	-	-

Table-2 presents the differential of neonatal mortality, post natal mortality and survival beyond one year that were obtained per 1000 live births. In bivariate analysis all the characteristics e.g. age of mother, region of birth, place of residence, education of mother, religion, wealth index, birth order, single/multiple births, size of the birth and place of delivery considered were found significantly associated with child survival. With increasing mother's age, decrease in postnatal mortality was slighter, but neonatal mortality declined sharply from 56.8 among mothers of age group below 20 years to 26.6 in the age group 30-49 years. In Central region, neonatal mortality (45.5) and postnatal mortality (21.0) were the highest and in Southern region, the lowest nearly half of Central region (24.5 and 10.0 respectively). In Western region both neonatal and post natal mortalities were almost similar to South Region; while in Eastern region was slightly lesser than Central region. North and North-East region

were also comparable for neonatal and post natal mortalities. Compared to urban areas both neonatal and post natal mortalities were higher by about 10 and 4 deaths per 1000 live births. Education of mothers had much impact on neonatal and postnatal mortalities; with the increase of education of mother, neonatal and postnatal mortalities decreased from 46.4 to 13.0 and from 21.9 to 4.8 in mothers with no education to higher secondary or above respectively. Among Hindus neonatal and postnatal mortalities were highest (36.1 neonatal mortality and 15.0 postnatal mortality) followed by Muslims, Sikh and Others with slightest variation; though the lowest was among Christians (21.7 neonatal mortality and 16.8 postnatal mortality) but did not differ much compared to Muslims, Sikh and Others. As wealth index was increasing, neonatal as well as postnatal mortalities were decreasing; neonatal and postnatal mortalities decreased from 46.5 to 20.9 and from 19.9 to 7.2 in mothers of poorest to richest wealth index respectively. Both neonatal as well as postnatal mortalities were highest (53.7 and 25.4) if the order of birth was 6^{th} or higher followed by among 4^{th} or 5^{th} order; both mortalities were lowest and almost similar in those born of either 1^{st} order or 2^{nd} order or 3^{rd} order. Very high neonatal as well as postnatal mortalities were found in multiple births compared to single births. The neonatal and postnatal mortalities in multiple births were higher by about 5.5 and 3.4 times than single births. Neonatal mortality of male born was slightly higher (35.7) than female born (31.1) but postnatal mortality was slightly higher in female born (16.2) than male born (14.4). Both neonatal and postnatal mortalities were highest if the child born was of very small size (79 neonatal deaths and 29.6 postnatal deaths) followed by smaller than average (39.2 neonatal deaths and 17.5 postnatal deaths). Lowest neonatal mortality was among children born with size larger than average. Both neonatal and postnatal mortalities were higher if the child was delivered at home compared to those delivered at institution; these were 35.7 and 19.6 among home delivered children and 29.4 and 9.2 in institutional delivered children respectively.

As seen in Table-2, all the characteristics were found to be associated with the survival of the children. To, isolate the confounding effects, logistic regression was carried with reference to children surviving beyond one year. Out of all the characteristics e.g. age, region, place of residence, education of mother, religion, wealth index, order of birth, single/multiple births, sex of child, size of the child and place of delivery considered in the model, all except the place of residence and religion, emerged significantly associated with neonatal and postnatal mortalities. Compared to born of mothers of age group 30-49 years, the risks of neonatal mortality to born of mothers of age group below 20 years and between 20-40 years were 1.47 (95% CI: 1.16-1.86) and 1.18 (95% CI: 1.02-1.37) times higher; while risk of postnatal mortality was 1.50 (95% CI: 1.06-2.13) times higher among the born in the age group below 20 years but almost similar to the born of age group 20-30 years. Compared to born of southern region, the risks of neonatal mortality was 1.89 (95% CI: 1.56 – 2.29), 1.41 (95% CI: 1.15 - 1.72) and 1.32 (95% CI: 1.07 - 1.63) times higher in Central, East and North regions but similar to North-East and Western regions; while post natal mortality was significantly higher by 1.46 (95% CI: 1.10 - 1.93) times in Central region only and were almost similar in all other regions. Compared to mothers with education higher secondary or above, the risks of neonatal mortality was 2.53 times in those born to mother with either no education or primary level and 1.90 (95% CI: 1.38 - 2.62) times higher in those born to mothers with secondary level education; while risks of postnatal mortality were 2.57 (95% CI: 1.52 - 4.36) and 2.20 (95% CI: 1.28 - 3.76) times higher in born to mothers with no education and primary level respectively but almost similar in born to mothers of secondary level. With

reference to born in richest families, the risk of neonatal mortality was decreasing as one move from lowest to richer wealth index but uncommonly post natal mortality was almost similar to born in poorest families. The risk of neonatal mortality was highest e.g. 1.64 (95% CI: 1.29 - 2.08) times among born to poorest families followed by 1.56 (95% CI: 1.25 -1.96), 1.37 (95% CI: 1.11 - 1.69) and 1.24 (95% CI: 1.02 - 1.51) times higher in born to poorer, middle and richer families respectively compared to born of richest families, but the postnatal mortality was comparable in born to richer and richest families while higher by 1.76 and 1.40 times in born of poorer and middle families. The risks of neonatal mortality to born of 2^{nd} or 3^{rd} order and 4^{th} to 5^{th} were lesser by 30% and 22% compared to born of 6^{th} order; while 1^{st} order born had almost same risk of neonatal deaths as of 6^{th} order. But the risk of post natal mortality was lesser by 29% only in born of 2^{nd} or 3^{rd} order; while similar in 1^{st} order and 4^{th} to 5^{th} order when compared with 6^{th} order. The risks of neonatal as well as postnatal mortality of multiple children born were 6.87 (95% CI: 5.59 - 8.44) and 4.28 (95% CI: 3.04 - 6.02) times higher than single born children. Neonatal mortality of male children was 1.17 (95% CI: 1.06 - 1.30) times higher than female children, but post natal mortality was almost similar in both the sexes. The size of child at birth had significant influence to both neonatal as well as post natal mortality. The risks of neonatal as well as post natal deaths had reduced nearly by half are even less in all categories of children size birth compared to the very small sized children. The risk of neonatal mortality was almost similar either the child was delivered at home or at institution, but postnatal mortality was 1.37 (95% CI: 1.13 - 1.67) times higher among children delivered at home when compared to the children delivered at the institution.

DISCUSSION

India achieved drastic reduction in past two decades and expected to be 39 per 1000 live births by the end of 2015; though could not achieve the targeted goal of 27. Earlier, data base had identified correlates of IMR as child sex & birth size, birth order and birth spacing, type of childbirth, mother's age at birth, religion, mother's education, household wealth status, and region of residence. [11] The neonatal deaths that contribute more than three fifth of infant deaths is of prime concern to achieve the goal; though none the less important is postnatal deaths. The present analysis has primarily focused to examine the determinants of neonatal and postnatal deaths separately in India, so as policy makers can modify the strategy, if feel, to achieve the goal. The determinants here considered were all concerned only to maternal and children e.g. geographical location, socio-economic & demographic characteristics. Geographical location considered the regional division of the country and demographic as age of mother and birth order; while socio-economic included religion, caste, place of residence, mother's education and family wealth index along with place of delivery. Children characteristics were sex and size at birth.

The analysis indicated highest risks of both neonatal (OR = 1.89; CI: 1.56-2.29) as well as post natal mortalities (OR = 1.46; CI: 1.10-1.93) in central region; while North-East, West and South are similar for neonatal mortality and all except Central region differ for postnatal mortality. Central region includes states Uttar Pradesh, Madhya Pradesh and Chhattisgarh; these are the economically poor states and poor health care access leading to higher mortalities of both neonatal and postnatal. The studies reconfirm the regional differences in mortality indicators highlighted by several studies and reiterated the case of economic inequality and health care access leading threat to the newborns at early age. [12-19] The highest neonatal mortality (OR= 1.47) and postnatal mortality (OR=1.50) of born to mothers below 20 years age indicating group being constituted by mothers marrying at lower ages who are of relatively

lower level of education and following cultural practice, living in poorer families and are expected to utilize less and less of mother and child health (MCH) care services compared to those middle and higher aged mothers, who are constituting higher marriage age mothers too and are expected to belong better economic families, comparatively of higher level education and may have better MCH services utilization thereby experiencing lower neonatal as well as post natal mortalities; undoubtedly and evidenced that MCH services utilization has its direct impact on IMR and a large differences in MCH utilization by urban–rural residence, educational attainment, religion, economic status and region were reported. [20] Moreover, adolescent mothers have higher likelihood of underweight born having more susceptibility to infections and in absence of proper treatment likelihood of death is high. Hence, focus should be more on delaying marriage age and promoting contraceptive practices if marriage not delayed to avoid early age pregnancy. In states with high neonatal and postnatal mortality; marriages below 18 year in spite of enforcement of Child Marriage Act, 2006 [21] defining legal marriage age are more than 30% (46% in Bihar, 41% in Rajasthan, 36 in Jharkhand, 33% in Uttar Pradesh and 29% in Madhya Pradesh). The highest effect of education of mothers with both neonatal and postnatal mortality is the effect of delayed marriage because of continuing education and the empowerment of women; as empowerment of women is directly associated with their education; moreover, educated women might be working and earning, hence keeping proper birth spacing and care of the born as well. Though working women work nature they perform is of labourer that cannot make them aware of nursing of new born.

Increasing wealth index had shown significantly decreasing mortality of neonatal mortality, while postnatal was only statistically higher among poorer and middle wealth index when compared to richest. The reason behind is richer and richest class have better nutrition, better utilization of mother and child health care system and better treatment in case of any infection or disease. Poor health indicators and high mortality have been established as the outcome of poor socioeconomic status, demographic stages, low female autonomy, [22,23] besides the poor health system performance and lower utilization of maternal and child health services. [24] Studies have reiterated the case of low age at marriages, premature births and frequent low spaced births following low birth weight whose likelihood of deaths during infancy is high. The risk factors for low birth weight is high among poor socioeconomic community, very young maternal age, poor diet (inadequate calorie intake, nutritional deficiencies of iron and zinc), and infections leading to early death. [25,26]

Compared to mothers proceeded to those 6^{th} and higher order, the risk of neonatal mortality was 30% and 22% lesser amongst mothers with birth order 2-3 and 4-5; while comparable to first order birth but postnatal mortality was found almost similar amongst 1^{st}, or 4^{th} to 5^{th} and 6^{th} & higher order births; only lesser by 30% among 2^{nd} to 3^{rd} order birth compared to 6^{th} & higher order. The first order births are generally at lower ages and higher order births (4^{th} or above) are only among illiterates and poor with short spacing and low birth weight which are more susceptible to disease infection and ultimately to death in absence of treatment. Although majority of the studies do not consider parity as a significant determinants but some support our findings, since birth order and birth spacing are significantly associated with neonatal deaths, so may be with IMR. [27,28] If multiple births, the risk of neonatal and postnatal mortality was very high 6.87 and 4.28 times higher than single birth; obviously these will be low birth weight born with high risk of mortality. Neonatal mortality was though seems slightly higher in male children than female children, but

statistically significant; however no sex difference was seen in postnatal mortality. Size of the child that indirectly is the measure of birth weight was significantly associated with both neonatal and postnatal mortality; larger was the size of child at birth, lesser was the neonatal and postnatal mortality. To combat the high maternal deaths and IMR resulting effect of neonatal and postnatal mortality, the move on Janani Suraksha Yojana (JSY), a cash incentive scheme launched by the Government of India appears beneficial for the poor. [29,30] However, problems related to heavy transactions, magnitude and political visibility along with growing corruption could hamper the effectiveness of JSY schemes. [15,31]

CONCLUSION

The findings suggest that rising marriage age, limited births through promoting family planning devices and MCH care can bring a quick reduction to both neonatal and post natal mortality and thereby in IMR and the target fixed can be achieved well in time.

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How to cite this article: Singh P, Mishra A, Mishra RN. Differential and determinants of neonatal and postnatal mortality in India. Int J Health Sci Res. 2016; 6(8):324-333.

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