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Death Clustering of Neonates & its Determinants in India

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ABSTRACT

The increased reach of health programs in India, during the past few decades, has significantly contributed to decline in postnatal mortality including infant, child & other mortality. However, reduction in neonatal mortality remained negligible. About 70% neonatal deaths take place within a week after birth. The prime objective of this study is to explore the death clustering of the neonates and its determinants in India. 3rd round of National Family Health Survey (NFHS-3), India, 2005-06 data was used for this study. Bivariate analysis followed by multivariate analysis (Binary logistic regression) was performed to identify the determinants of neonatal mortality. Moran's I & Univariate LISA cluster map was used to explore the spatial clusters of neonatal deaths in India. Univariate Moran's I (Moran's I=0.215) was significant i.e. spatial dependence exists for neonatal deaths in Indian states. The Univariate LISA cluster map explored significant hotspots of neonatal deaths which were Bihar, Chhattisgarh, Jharkhand, MP, Odisha, Rajasthan, UP and WB. The estimated odds of neonatal death was 2.75 times higher (OR=2.75; 95% CI: 2.21-3.43) among smaller size neonates than the average & larger size neonates. The odds of neonatal death was found 2.39 times, 2.73 times & 1.84 times higher among those mothers who had an illiterate, primary & secondary level of education as compared to mothers who had higher education. The risk of neonatal death among 1st (OR=1.43) and more than 4th (OR=1.35) order births was positively higher than 2nd to 3rd order births. Based on the findings, the study proposes various approaches to address the increasing contribution of neonatal deaths in India. The findings suggest that raising mother education & providing a healthy diet to pregnant women, can bring a quick substantial reduction of neonatal mortality and the target fixed can be achieved. So, it is necessary to encourage & support women for higher education. This study proposes to provide the combination of the continuum care for maternal, neonatal, and child health by integrating a family-community based service delivery approach with the existing health care system specially to the death clusters in India.

Introduction

The global focus has mainly been on reducing under five mortality [**1–3**], and to some extent, infant mortality, the issues of neonatal mortality (i.e. the death of newborns within 28 days after their birth) are still shrouded, and India is no exception. The major public health interventions during the last two decades have been focused on reduction in infant and child mortality [**4**]. The WHO [**5**] estimated indicate that every year across the world, over 4 million babies die in the first 4 weeks of life; 3 million of these deaths occur in the early neonatal period. Most neonatal deaths (99 %) arise in low-income and middle income countries, and about half occur at home. The highest number of neonatal deaths is in south-central Asian countries and the highest rates are generally in sub-Saharan Africa. The countries in these regions (with some exceptions) have made little progress in reducing such deaths in past 10–15 years. In poor communities, many babies who die are unnamed and unrecorded, indicating the perceived inevitability of their deaths [**6**]. In 2013, the neonatal mortality rate was 28 per 1000 live births, ranging from 15 in urban areas to 31 in rural areas and was contributing 68% of the total infant death [**7**]. Only in six major states such as Odisha, Uttar Pradesh (UP), Bihar, West Bengal, Rajasthan and Madhya Pradesh (MP) constituting nearly half (45.4%) of the country population, neonatal mortality rate is very high ranging from lowest in West Bengal (21) to highest in Odisha (37) and MP (36) as against only 6 in Kerala [**8**]. Although the debate on neonatal and perinatal mortality profoundly affected by socioeconomic determinants and health care practices is not strange to health literature [**9–11**], there have been few attempts to assess the early neonatal mortality. However, researchers across the globe have come to a proximate consensus that further reduction in overall infant mortality cannot be achieved without addressing the growing contribution of neonatal deaths, particularly in developing countries including India.

Undoubtedly, for a further quick reduction in IMR, neonatal deaths contributing much needs to be addressed [**11-12**]. The information on the causes of early neonatal mortality is scarce; however, the direct causes of neonatal deaths are often approximated with early neonatal mortality. The literature emphasizes the role of demographic and Socio economic characteristics of mother and children in determining the survival of the newborn at an early age [**13-17**].

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Neonatal mortality is a very sensitive indicator of health not only for children but also to mothers and economic development as well. High neonatal mortality is likely to increase rates of illness and putting pressure on the health care delivery system. Continued reproduction process to replace the loss of child increases the economic loss that is involved during pre and post natal care and thus obviously affecting the health and economic development of the nation as a whole. Though, the target of IMR fixed till 2015 could not be achieved and it is difficult to achieve without the reduction of the rate of neonatal mortality, but the sharp decline in the recent years is likely to narrow the gap between the achievement and the target. The policy makers always are in search of pockets with high neonatal deaths and the influencing factors so as need based feasible and cost effective policies can be formulated to achieve the maximum reduction to fulfil the target. Hence, it becomes pertinent to identify the influencing factors of Neonatal mortality. With the backdrop of the above enquiries, the purpose of this study is to assess the socioeconomic and demographic correlates of neonatal mortality in India, so as a concrete suggestion on modifiable characteristics can be delivered to the policy makers.

Data and Methods

Present study utilizes data from third round National Family Health Survey (NFHS-3) conducted during 2005–06 under the stewardship of Ministry of Health and Family Welfare, Government of India [**18**] International Institute for Population Sciences, Mumbai, being the nodal agency had involved 18 Research Organizations to conduct nationwide survey work for more than 109,041 households, 124,385 women aged 15-49, and 74,369 men aged 15-54 which covered 99% of India's population living in all 29 states. From among all the women and men interviewed nationwide, 102,946 were tested for HIV. NFHS-3 enables to measure and compare state and nation wise trend of family welfare programs e.g. fertility, family planning practices, infant and child mortality, maternal and child health and utilization of MCH services. The present analysis is concentrated on 33,049 recorded births. The dependent variable is neonatal mortality which is defined as the probability of dying of the new born before reaching 28 days of life span. The variation in neonatal death was viewed according to demographic characteristics (mother age, birth order, ANC visit, child sex & child size), socio economic characteristics (religion, caste, mother's education & wealth index) and geographical location and cultural setting (place of residence, region of birth place & place of delivery) as well. The reason behind to include a region of child birth is to adjust the estimates for regional variation [**18**].

Statistical Analysis

Unadjusted and adjusted binary logistic regression model with 'logit' link were applied to identify the possible socio-demographic predictors associated with the response variable neonatal mortality with 95% confidence interval of the estimated odds ratios.

The binary response (1=Dead, 0= Alive) for each neonate was related to a set of categorical predictors, X by a *'logit'* link function:

$$logit\ [\ P(Y=1)] = ß_0 + ß^*X + \epsilon$$

The parameter $ß_0$ estimates the log odds of neonatal mortality for the reference group; the parameter $ß$ estimates with maximum likelihood, the differential log odds of neonatal mortality associated with the set of predictors X, as compared to the reference group and ϵ represents the residuals in the model. It is worth mentioning that all the variables identified as significant in the bivariate analyses using the χ^2 test were included in the binary logistic regression model.

To check the spatial dependence, Moran's I (A measure of spatial autocorrelation) were calculated and simulation were also carried out to generate sig. value. Univariate LISA cluster map was plotted to explore the death clusters of neonates.

The analysis was carried out using STATA version 13, SPSS version 20.0 & Geo Da 1.8.14.

Results

Table-1 represents the frequency distribution of mothers of neonates for their background characteristics e.g. region & place of residence, religion, caste, wealth index, age, education, Place of delivery, ANC visit & Parity along with neonate characteristics e.g. child sex & birth order. Among the respondents surveyed, maximum (23.41%) were from the central region and minimum from the western region (11.54%) and rest from the north, east, north-east and south varying between 14.85% to 18.03%. About 60.46% belonged to rural areas with nearly 75% being Hindu and 67% SC/ST and OBC combined.

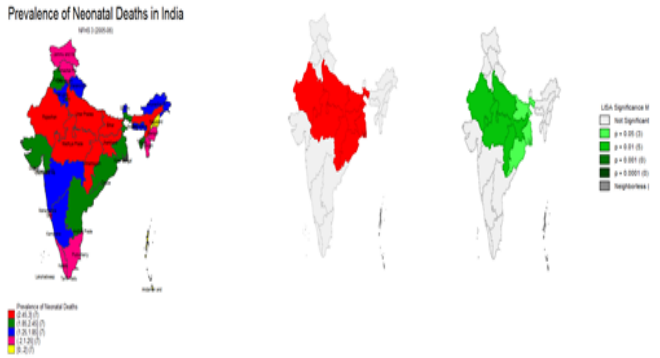

Fig . LISA Cluster Map of Neonatal Deaths in India.

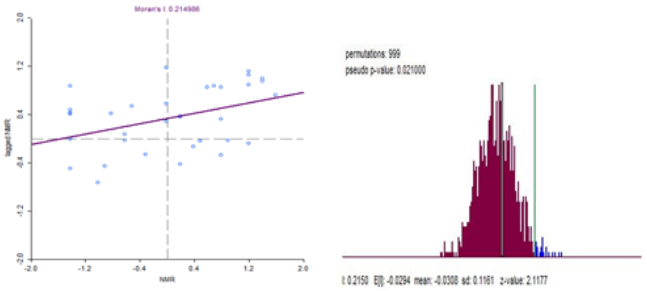

Fig. LISA Significance map

Nearly 35% were falling to poorest or poorer wealth quintile. Most of the mothers were above the age of 25 years and nearly 6% were aged ≥15 years during survey time. More than half (55%) mothers had no formal education. Among the babies born nearly 54% were male. More than 47% respondents had birth order between two to three and those who had experienced childbirth, nearly 47% had ANC visit more than 4 times. The majority of the respondent delivered more than 75% birth at home. About 80% of the neonate had birth weight average & larger.

Table 1. Frequency and percentage distribution of background characteristics of neonates, NFHS-3 (2005-06), INDIA.

Background characteristics	%	95% CI	Background characteristics	%	95% CI
Region of India			**Place of residence**		
North	18.03	17.63-18.45	Rural	60.46	59.93-60.98
Central	23.41	22.96-23.87	Urban	39.54	39.02-40.07
East	16.50	16.08-16.88	Religion		
North-East	14.85	14.47-15.24	Hindu	75.01	74.54-75.47
West	11.54	11.20-11.89	Muslim	14.15	13.78-14.53
South	15.70	15.30-16.09	Others	10.84	10.51-11.17
Caste			**Wealth Index**		
Others	33.07	32.57-33.58	Poorest	17.14	16.74-17.55
Schedule Caste	18.27	17.85-18.69	Poorer	17.25	16.85-17.66
Schedule Tribe	13.84	13.47-14.21	Middle	19.73	19.30-20.16
OBC	34.40	33.89-34.90	Richer	21.90	21.46-22.35
Age of mother (years)			Richest	23.99	23.53-24.45
Adolescent (15-19)	5.92	5.67-6.18	**Child Sex**		
Middle Age (20-24)	31.31	30.81-31.81	Male	53.75	53.22-54.29
Old Age (25-49)	62.77	62.25-63.30	Female	46.25	45.71-46.78
Birth Order			**Mother's Education**		
1	28.60	28.11-29.09	No education	40.84	40.42-41.27
2-3	47.03	46.49-47.57	Primary	14.50	14.20-14.81
≥ 4	24.38	23.91-24.84	Secondary	37.05	36.64-37.47
ANC Visit			Higher	7.60	7.38-7.83
None	18.07	17.66-18.49	**Child size at birth**		
1	5.35	5.11-5.60	Very Small	6.13	5.87-6.39
2	15.59	15.20-15.98	Small	14.56	14.19-14.94
3	14.53	14.15-14.91	Average & Larger	79.31	78.88-79.75
4+	46.47	45.93-47.00	**Place of Delivery**		
			Home Delivery	75.77	75.30-76.22
			Institutional Delivery	24.23	23.78-24.70

Graphs & Maps shows the spatial pattern & clusters of neonatal deaths in India. Univariate Moran's I (Moran's I=0.215) was significant i.e. spatial dependence exists for neonatal deaths in Indian states.

The Univariate LISA cluster map explored significant hotspots of neonatal deaths which were Bihar, Chhattisgarh, Jharkhand, MP, Odisha, Rajasthan, UP and WB.

Table 2. Association of Neonatal mortality with background characteristics of the mother: Bivariate analysis, NFHS-3 (2005-06), INDIA.

Background characteristics	N	NMR (%)	Background Characteristics	N	NMR (%)
Region of India			**Place of residence**		
North	110	1.8	Rural	463	2.3
Central	226	2.9	Urban	206	1.6
East	128	2.3		$\chi^2 = 22.07$, p = 0.000	
North-East	78	1.6	**Religion**		
West	60	1.6	Hindu	524	2.1
South	67	1.3	Muslim	85	1.8
	$\chi^2 = 57.05$, p = 0.000		Others	60	1.7
Caste				$\chi^2 = 4.20$, p = 0.122	
Others	178	1.6	**Wealth Index**		
Schedule Caste	156	2.6	Poorest	172	3.0
Schedule Tribe	87	1.9	Poorer	146	2.6
OBC	248	2.2	Middle	137	2.1
	$\chi^2 = 19.83$, p = 0.000		Richer	126	1.7
Age of mother (years)			Richest	88	1.1
Adolescent (15-19)	66	3.4		$\chi^2 = 74.25$, p = 0.000	
Middle Age (20-24)	229	2.2	**Place of Delivery**		
Old Age (25-49)	374	1.8	Home Delivery	520	2.1
	$\chi^2 = 25.00$, p = 0.000		Institutional Delivery	149	1.9
ANC Visit				$\chi^2 = 1.41$, p = 0.234	
None	177	3.0	**Mother's Education**		
1	52	2.9	No education	342	2.7
2	129	2.5	Primary	120	2.6
3	87	1.8	Secondary	187	1.5
4+	224	1.5	Higher	20	0.7
	$\chi^2 = 65.90$, p = 0.000			$\chi^2 = 82.99$, p = 0.000	
Child Sex			**Child size at birth**		
Male	384	2.2	Very Small	106	5.2
Female	285	1.9	Small	100	2.1
	$\chi^2 = 3.63$, p = 0.051		Average & Larger	463	1.8
Birth Order				$\chi^2 = 113.96$, p = 0.000	
1	210	2.2	**No weights was used to calculate any estimates in this research article i.e. all the sample estimates provided here are unweighted.		
2-3	244	1.6			
≥ 4	215	2.7			
	$\chi^2 = 34.96$, p = 0.000				

Table-2 shows the association of neonatal mortality with background characteristics of mother and child. All of the background characteristics except the place of delivery, religion & sex of the neonate were found significantly associated with neonatal mortality. Highest neonatal death was in the central region (2.9%) than all other regions and among mothers belonging from rural (2.3%) background.

Among Hindus and Muslims, neonatal death was nearly same around 2% compared to among other religious group (1.7%) and it was maximum among SC (2.6%) followed by OBC (2.2%) and ST (1.9%). As wealth quintile index increased, neonatal death decreased significantly from 3.0% among poorest to 1.1% among richest. Highest neonatal mortality was recorded among adolescent mothers (3.4%) followed by 2.2% among 20-24 years mothers.

Neonatal mortality decreased significantly from 3.0% among those mothers who didn't or 1 times visited ANC to 1.5 among 4 & above times ANC visited mothers. Increasing the level of education had shown significant decreasing trend of neonatal deaths; highest among illiterates (2.7%) and lowest among higher education (0.7%) women. In first and 4^{th} or higher order births, neonatal death was higher than 2^{nd} or 3^{rd} order births. Neonatal death was significantly higher among male child (2.2%) than a female child. Highest neonatal death (5.2%) was recorded in case of very small size neonates.

Table-3 presents the estimated odds of occurrence of neonatal deaths by selected demographic and socioeconomic determinants using a binary logistic regression Model. Bivariate analysis indicated an association of neonatal mortality with all the characteristics except the place of delivery, religion & sex of the neonate; while in multivariate analysis region, child size at birth, birth order, education & age of mother emerged significant association with neonatal mortality. The odds of neonatal death was 1.8 times higher (OR=1.79; 95% CI: 1.33-2.42) among births to Central region of India, 1.37 times higher among births to the eastern region of India, than the Southern part of India. The estimated odds of neonatal death was 2.75 times higher (OR=2.75; 95% CI: 2.21-3.43) among smaller size neonates than the average & larger size neonates. The odds of neonatal death was found 2.39 times, 2.73 times & 1.84 times higher among those mothers who had an illiterate, primary & secondary level of education compared to mothers who had higher education. The risk of neonatal death among 1^{st} (OR=1.43) and more than 4^{th} (OR=1.35) order birth was positively higher than 2^{nd} -3^{rd} order birth category. Although it was found that odds of neonatal death were 1.46 times higher among adolescents (OR=1.46; 95% CI=1.06-2.01) mothers than old age mothers.

Table 3. Unadjusted & Adjusted Odds Ratio (OR) of Neonatal Mortality estimated using a Binary Logistic Regression Model, NFHS-3 (2005-06), India.

Covariates	Categories	Unadjusted Odds Ratio	Adjusted Odds Ratio	95% C.I.
Region	North	1.442**	1.263	0.912-1.749
	Central	2.299**	1.792**	1.329-2.417
	East	1.844**	1.378**	1.003-1.893
	North-East	1.253	1.151	0.808-1.641
	West	1.224	1.297	0.907-1.856
	South (Ref.)	1.000	1.000	
Place of Residence	Urban	0.674**	0.955	0.784-1.164
	Rural (Ref.)	1.000	1.000	
Religion	Hindu	1.266		
	Muslim	1.084		
	Others (Ref.)	1.000		
Caste	Others	0.742**	0.957	0.778-1.176
	Schedule Caste	1.189	1.132	0.920-1.391
	Schedule Tribe	0.870	0.836	0.639-1.093
	OBC (Ref.)	1.000	1.000	
Wealth Index	Poorest	2.791**	1.361	0.943-1.963
	Poorer	2.347**	1.254	0.885-1.777
	Middle	1.919**	1.193	0.864-1.647
	Richer	1.579**	1.160	0.861-1.563
	Richest (Ref.)	1.000	1.000	
Place of Delivery	Home Delivery	1.118		
	Institutional Delivery(Ref.)	1.000		
Child size at birth	Very Small	3.070**	2.753**	2.212-3.426
	Small	1.180	1.078	0.865-1.342
	Average & Larger (Ref.)	1.000	1.000	
Mother's Age	Adolescent (15-19)	1.904**	1.458**	1.059-2.006
	Middle Age (20-24)	1.232**	1.191	0.977-1.453
	Old Age (25-49) (Ref.)	1.000	1.000	
Mother's Education	No education	4.136**	2.397**	1.420-4.045
	Primary	4.015**	2.737**	1.614-4.641
	Secondary	2.250**	1.838**	1.126-2.999
	Higher	1.000	1.000	
Child Sex	Male	1.162		
	Female (Ref.)	1.000		
Birth Order	1	1.426**	1.428**	1.161-1.756
	4 and above	1.720**	1.350**	1.089-1.675
	2-3 (Ref.)	1.000	1.000	
ANC Visit	None	2.062**	1.229	0.960-1.574
	1	2.048**	1.221	0.877-1.700
	2	1.738**	1.088	0.847-1.396
	3	1.248	0.861	0.659-1.124
	4+ (Ref.)	1.000	1.000	

'**=Significant' & rest 'insignificant'

Discussion

Estimates based on two-level logistic regression model indicate that a number of factors were significantly associated with neonatal mortality i.e. birth size, birth order, mother's age, mother's education and region of residence [**19**]. Drastic reduction in IMR in India that is expected to be 39 per thousand live births by the end of 2015 clearly indicating India's sagging effort to controlling the neonatal deaths of newborn. The present study has primarily focused to examine the determinants of neonatal mortality in India, so as need based policy can be revised. The analysis indicated risk of neonatal death was much higher in the central & east region including states Uttar Pradesh, Madhya Pradesh, Bihar, Assam, Jharkhand, Odisha, Chhattisgarh etc. than all other regions; these are the states which are economically backward and poor health care access leading to higher neonatal mortality. Further, the study reconfirms the regional differences in mortality indicators highlighted by several studies [**19-23**]. Evidence from South Asian countries including India [**10**, **24**], Bangladesh [**15**], Nepal [**43**] and Pakistan [**17**] manifest the need for a package of approaches to deal with the higher rate of neonatal deaths. This clearly indicates India's sagging effort in controlling the early deaths of newborn babies. Consistent with previous findings [**6**, **16**, **25**], this study shows that the risk of neonatal death was significantly higher amongst the babies of small size at birth (or low birth weight). There are a number of risk factors for low birth weight, such as poor socioeconomic conditions, very young maternal age, poor diet (inadequate calorie intake, nutritional deficiencies of iron and zinc), and infections [**14**]. In the majority of the South Asian countries, the practice of restricting food intake during pregnancy is prevalent, which leads to the incidence of low birth weight [**26**]. However, the promotion of early and exclusive breastfeeding [**9**], prevention and treatment of hypothermia, including kangaroo mother care [**27**], topical skin-cleansing [**28**], topical emollient (sunflower oil) treatment for hospitalized newborns [**29**], and home-based management of low-birth weight and preterm neonates with supportive care and treatment of infections [**24**] may reduce morbidity and mortality among low-birth weight, including premature births. An appropriate advice regarding nutrition to women by healthcare providers to the family members before conception and a comprehensive antenatal check-up system contributed to the success in Cuba [**30- 31**]. Our study also reveals that birth order is significantly associated with early neonatal mortality [**32-33**]. Increasing birth order was found to be positively associated with neonatal mortality [**44**]. However a study on utilization of maternal health services suggested that higher mortality risk among first order birth could be linked to the early childbearing trends and lower utilization of maternity services in developing countries like India [**34**]. In addition, Santhya et al. [**35**] showed that a substantial proportion of young married women in India had experienced at least one pregnancy-related complication during pregnancy, delivery or the postpartum period for the first birth. About 16 million adolescent girls aged 15–19 give birth each year, and almost 95 % of these births occur in developing countries [**36**]. Such pregnancies have been consistently associated with increased risk of adverse pregnancy outcome, especially low birth weight, and prematurity [**37**]. Our findings reveal that maternal education significantly reduce the odds of neonatal death. 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 inputs [**38-39**]. Maternal education is argued to improve child health through increased knowledge about the practices to improve child health and increased use of maternal care services. After an extensive review suggest that the potential links between maternal education and reduced neonatal mortality also include appropriate birth spacing and health seeking behaviour, particularly for prenatal care [**9**]. A study highlighted that even rural adolescent married woman in India, who had primary and above level of education were more likely to utilize antenatal care compared to illiterate women [**30**]. Thus, although some studies do not support our findings but some of them do. To combat the high neonatal and maternal deaths, the move on Janani Suraksha Yojana (JSY), a cash incentive scheme launched by the Government of India [**40**] appears beneficial for the poor [**41**]. However, problems related to heavy transactions, magnitude and political visibility along with growing corruption could hamper the effectiveness of JSY schemes [**21, 42**].

Conclusion

Based on the findings, the study proposes various approaches to address the increasing contribution of neonatal deaths in India. The findings suggest that raising mother education & providing a healthy diet to pregnant women, can bring a quick substantial reduction of neonatal mortality and the target fixed can be achieved. So, it is necessary to encourage & support women for higher education. This study proposes to provide the combination of the continuum care for maternal, neonatal, and child health by integrating a family-community based service delivery approach with the existing health care system specially to the death clusters in India.

Reference

1. UNICEF (2009) State of the world's children 2010, United Nations Children's Fund. New York, USA

2. United Nations (2009) The millennium development goals report 2009, New York, United Nations.

3. WHO (2009) World health statistics 2009, World Health Organization, Geneva.

4. WHO (2005) *MDG: Health and the millennium development goals*, World Health Organization, Geneva.

5. WHO (2006) Neonatal and perinatal mortality: Country, regional and global estimates, World Health Organization, Geneva.

6. Lawn, J. E., Cousens, S., Zupan, J., & Lancet Neonatal Survival Steering Team (2005) 4 million neonatal deaths: When? Where? Why? Lancet 365(9462), 891–900.

7. Office of the Registrar General and Census Commissioner, India (2013) Estimates of Mortality Indicators. SRS Statistical Report 2013, Chapter-I, India,
URL:
http://www.censusindia.gov.in/vital_statistics/SRS_Reports_2013.html (accessed 3rd March, 2015).

8. Office of the Registrar General and Census Commissioner, India (2011) Primary Census Data Highlights, Chapter 1-Population, Size and Decadal Change,India,
URL:http://www.censusindia.gov.in/2011census/PCA/PCA_Highlights/pca_highlights_india.html (accessed 3rd March, 2015).

9. Bhutta, Z. A., Darmstadt, G. L., Hasan, B. S., & Haws, R. A. (2005) Community-based interventions for improving perinatal and neonatal health outcomes in developing countries: A review of the evidence. Pediatrics 115(2 Suppl), 519–617.

10. Kumar, V., Mohanty, S., Kumar, A., Misra, R. P., Santosham, M., Awasthi, S., et al. (2008). Effect of community-based behavior change management on neonatal mortality in Shivgarh, Uttar Pradesh, India: A cluster-randomised controlled trial. Lancet, 372(9644), 1151–1162.
11. Bhutta Z A, Ahmed T, Black R E, et al. (2008) What works? Interventions for maternal and child under nutrition and survival. Lancet 371:417–440
12. The Million Death Study Collaborators (2010) Causes of neonatal and child mortality in India: A nationally representative mortality survey. Lancet 376:1853–1860.
13. Shonkoff, J. P., Richter, L., van der Gaag, J., & Bhutta, Z. A. (2012) An integrated scientific framework for child survival and early childhood development. Pediatrics 129(2), e460–e472.
14. Saugstad, O. D. (2011) Reducing global neonatal mortality is possible. Neonatology 99: 250–257.
15. Azad, K., Barnett, S., Banerjee, B., Shaha, S., Khan, K., Rego, A. R., et al. (2010) Effect of scaling up women's groups on birth outcomes in three rural districts in Bangladesh: A cluster-randomised controlled trial. Lancet 375(9721), 1193–1202.
16. Titaley, C. R., Dibley, M. J., Agho, K., Roberts, C. L., & Hall, J. (2008) Determinants of neonatal mortality in Indonesia. BMC Public Health 8: 232.
17. Ayaz, A., & Saleem, S. (2010) Neonatal mortality and prevalence of practices for newborn care in a squatter settlement of Karachi, Pakistan: A cross-sectional study. PLoS One 5(11), e13783.
18. International Institute for Population Sciences (IIPS) & Macro International (2007) National Family Health Survey (NFHS-3) 2005–06: India. IIPS, Mumbai.
19. Kumar C, Singh PK, Rai RK, Singh L. (2013) Early Neonatal Mortality in India: 1990–2006. J Community Health. 38:120–130.
20. Sahu D, Nair S, Singh L, Gulati BK, Pandey A. (2015) Levels, trends & predictors of infant & child mortality among Scheduled Tribes in rural India. Indian J Med Res. 141:709-719.
21. Malini S, Tripathi RM, Khattar P, Nair K, Tekhre Y, Dhar N, et al. (2008) A rapid appraisal on functioning of Janani Suraksha Yojana in South Orissa. Health and Population: Perspectives and Issues. 31:126–131.
22. Subramanian S V, Nandy S, Irving M, Gordon D, Lambert H, Davey SG. (2006) The mortality divide in India: The differential contributions of gender, caste and standard of living across the life course. American Journal of Public Health 96(5): 818–825.
23. Arokiasamy P, Gautam, A. (2008) Neonatal mortality in the empowered action group states of India: Trends and determinants. Journal of Biosocial Science 40: 183 -201.
24. Bang AT, Baitule SB, Reddy HM, Deshmukh MD, Bang RA. (2005) Low birth weight and preterm neonates: can they be managed at home by mother and a trained village health worker? Journal of Perinatology 25(Suppl1): S72–S81.
25. Ngoc, N. T., Merialdi, M., Abdel-Aleem, H., Carroli, G., Purwar, M., Zavaleta, N., et al. (2006) Causes of stillbirths and early neonatal deaths: Data from 7993 pregnancies in six developing countries. Bulletin of the World Health Organization, 84, 699–705.
26. Save the Children. (2001) The state of the world's newborn. Washington, DC: Save the Children.
27. Conde-Agudelo, A., Beliza´n, J. M., & Diaz-Rossello, J. (2011) Kangaroo mother care to reduce morbidity and mortality in low birthweight infants. Cochrane Database of Systematic Reviews 3(CD002771).
28. McClure, E. M., Goldenberg, R. L., Brandes, N., Darmstadt, G. L., Wright, L. L., et al. (2007) The use of chlorohexidine to reduce maternal and neonatal mortality and morbidity in lowresource settings. International Journal of Gynaecology and Obstetrics, 97, 89–94.
29. Darmstadt, G. L., Bhutta, Z. A., Cousens, S., Adam, T., Walker, N., de Bernis, L., et al. (2005) Evidence-based, cost-effective interventions: How many newborn babies can we save? Lancet 365, 977–988.
30. Lopez, N. B., & Choonara, I. (2009). Can we reduce the number of low-birth-weight babies? The Cuban experience. Neonatology 95, 193–197.
31. Rodriguez, F. V., Lopez, N. B., & Choonara, I. (2008) Child health in Cuba. Archives of Disease in Childhood 93, 991–993.
32. Bhalotra, S., & van Soest, A. (2008) Birth-spacing, fertility and neonatal mortality in India: Dynamics, frailty, and fecundity. Journal of Econometrics 43(2), 274–290.
33. Mercer, A., Haseen, F., Huq, N. L., Uddin, N., Hossain Khan, M., & Larson, C. P. (2006) Risk factors for neonatal mortality in rural areas of Bangladesh served by a large NGO programme. Health Policy and Planning 21(6), 432–443.
34. Singh, P. K., Rai, R. K., Alagarajan, M., & Singh, L. (2012) Determinants of maternity care services utilization among married adolescents in rural India. PLoS One 7(2), e31666.
35. Santhya, K. G., Jejeebhoy, S. J., & Ghosh, S. (2008) Early marriage and sexual and reproductive health risks: Experiences of young women and men in Andhra Pradesh and Madhya Pradesh, India. New Delhi: Population Council.
36. WHO (2008) Adolescent pregnancy. Geneva: World Health Organization.
37. Raj, A., Saggurti, N., Winter, M., Labonte, A., Decker, M. R., Balaiah, D., et al. (2010) The effect of maternal child marriage on morbidity and mortality of children under 5 in India: crosssectional study of a nationally representative sample. British Medical Journal 21, b4258.
38. Chomba, E., McClure, E. M., Wright, L. L., Carlo, W. A, Chakraborty, H., & Harris, H. (2008) Effect of WHO newborn care training on neonatal mortality by education. Ambulatory Pediatrics 8(5), 300–304.
39. Frost, M. B., Forste, R., & Haas, D. W. (2005) Maternal education and child nutritional status in Bolivia: Finding the links. Social Science and Medicine 60(2), 395–407.
40. Government of India (2006) Janani Surkasha Yojana (JSY: Features). Ministry of Health and FamilyWelfare, New Delhi.
41. Lim, S. S., Dandona, L., Hoisington, J. A., James, S. L., Hogan, M. C., & Gakidou, E. (2010) India's Janani Suraksha Yojana, a conditional cash transfer programme to increase births in health facilities: An impact evaluation. Lancet 375, 2009–2023.
42. Paul, V. K. (2010) India: Conditional cash transfers for infacility deliveries. Lancet 375(9730), 1943–1944.
43. Lee, A. C. C., Mullany, L. C., Tielsch, J. M., Katz, J., Khatry, S. K., LeClerq, S. C., et al. (2008) Risk factors for neonatal mortality due to birth asphyxia in Southern Nepal: A prospective, community-based cohort study. Pediatrics 121, e1381–e1390.
44. Pandey A, Bhattacharya BN, Sahu D, Sultana R. (2004) Are too early, too quickly and too many births the high risk births: an analysis of infant mortality in India using National Family Health Survey. Demography India 33: 127-56.