Twin Births and Neonatal mortality in India: Trend and Patterns, 1992-2016

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Extended Abstract

Context

In recent times, the use of assisted reproductive technology and rise in maternal age has led to an increase in number of twin pregnancies worldwide. The proportion of twins to total births is low, however, compared with singletons, twins experience a higher risk of adverse peri-natal outcomes. The burden of twin mortality needs to be carefully investigated in India since reducing the burden of twin mortalities can aid India in achieving the Sustainable Development Goal (SDG) commitments of the Government of India. As such, the SDGs call for reducing neonatal mortality by half, from the current level of 29.5 per 1000 live births to as low as 12 by 2030. Although India achieved sizeable gains in reducing child mortality over the last 25 years, the progress in reducing neonatal mortality has been much slower.

There are a number of complications related to twin pregnancies such as preeclampsia, post-partum haemorrhage and preterm birth. Obstetric complications can not only lead to high neonatal mortality but also contributes to maternal deaths. The chances of twins suffering from congenial malformation are higher and they are more vulnerable during first year of life. The added risk due to multiple pregnancies as well as the higher health care cost on account of special prenatal and postnatal care can affect the households financially as well as psychologically. While twinning rates have been extensively studied in Western and African countries, there is a scarcity of reliable data for such rates in India. In the context of India, recent studies are based on small samples and have mostly focused on maternal outcomes. Against this backdrop, this paper has the following objectives.

Objectives

- To understand the trends and patterns in mortality among twins as well as singletons over the period 1992-93 to 2015-16
- To analyse socioeconomic inequalities in mortality rates in twins and singletons
- To estimate the share of mortality burden associated with twinning vis-à-vis singletons

Methodology

Data

The present study uses the data from the four rounds of the National Family Health Survey (NFHS) of India conducted during 1992-93, 1998-99, 2005-06 and 2015-16, respectively. The

principle objective of NFHS is to provide information about fertility, mortality, family planning and other aspects of health and nutrition. Information about socio-economic characteristics of the respondents is also provided.

Variables

The dependent variables included information about whether child is alive or not. The information has been considered for live births in last five years to make a meaningful comparison. The independent variables used in the analyses include the type of child birth, women's education, place of residence, household's social class, wealth quintile, gender of child, weight of child at birth and place of delivery. Type of birth is the variable of interest and is coded as singletons "0", first birth of the twins "1" and second birth of the twins "2". Education of women and weight of child are continuous variables which were categorized for the analyses. Rest of the exposure variables are categorical variables and re-coded/ combined depending on the number of observations within the categories.

For the women's education four categories were created depending upon the number of years of education: illiterate (0 years), primary (1 to 8 years), secondary (9 to 10 years); and higher secondary and above (more than 10 years). Four categories for Social caste have been defined: Schedule Caste (SC) and Schedule Tribe (ST) which are considered as marginalized communities. Other two categories are Other Backward Class (OBC); and Others (who does not belong to other mentioned groups). Households are divided into five categories based on wealth score: lowest, second, middle, fourth and highest. Place of residence indicates whether households reside in rural or urban areas. Three categories have been created for the place of delivery recorded at the time of the interviews: home, public; and private. Gender of child is categorized as either "Male" or "Female". Two categories have been created for the variable "weight of child at birth": less than or equal to 2.5 kilograms; and more than 2.5 kilograms.

Statistical Analysis

Univariate and Bivariate analyses was conducted to understand the trends and patterns in neo-natal mortality. The neo-natal mortality rates were computed using the *syncmrates* command in Stata. Syncmrates uses the synthetic cohort probability method for computing the mortality rate. Three variables which are required for the calculations are date of birth, date of interview and age at death. Mortality rates were computed for the 5 years preceding the interview. The mortality rates were calculated separately for each category of socio-economic groups. Women weights in NFHS data were used to account for variation in sampling. In NFHS, information about place of delivery is available for the last live birth only. The mortality burden were calculated using the live births and the mortality rates obtained using the syncmrates command, 95 per cent CI values are also presented for mortality rates and burden. Logistic regressions were used to identify the risk factors associated with survival of the child. Regression models were calibrated for each round of NFHS. In the models, the outcome variable was coded as child dying within 28 days of birth "1" and child survived first 28 days "0".

Main Conclusions

The proportion of twin births to total live births in NFHS-1 and NFHS-2 was 1.44 and 1.47 per cent respectively. The percentage of twins in total sample is higher in NFHS-4 (1.63 per cent) as compared to earlier rounds. Over time an upward trend in the number of twin births is observed (Table 1).

Table 1: Percentage distribution of twins and singletons across various rounds of NFHS

Births	NFHS-1 (1992-93)	NFHS-2 (1998-99)	NFHS-3 (2005-06)	NFHS-4 (2015-16)
	N (%)	N (%)	N (%)	N (%)
Overall	60625 (100)	56734 (100)	51555 (100)	259627 (100)
Singletons	59736 (98.5)	55896 (98.5)	50750 (98.4)	255327 (98.3)
Twins	874 (1.44)	832 (1.47)	780 (1.51)	4232 (1.63)

Note: Figures in parenthesis are percentage of total live births in last 5 years

It is being observed that a higher proportion of twin births took place in rural areas where assisted reproductive technologies are not available. But, the number of deliveries taking place at private facilities have increased. As per NFHS-4, a higher proportion of twin births in rural areas have taken place at public facilities (47 per cent). However, a consistent increase in deliveries at private facilities across both rural and urban areas is observed.

Table 2: Neo-Natal Mortality among Singletons and Twins, NFHS

	1992-93	1998-99	2005-06	2015-16
Singletons				
Live births	60625	56734	51555	259627
Deaths	2671	2302	1908	7069
Neo-natal mortality rate	44.1	40.6	37.0	27.2
(95% CI)	(42-46.1)	(38.2-42.9)	(34.6-38.5)	(26.3-28.1)
Twins				
Live births	874	832	780	4232
Deaths	291	194	141	662
Neo-natal mortality rate	332.5	233.2	181.0	156.5
(95% CI)	(292-373.1)	(196.9-269.6)	(141.7-220.8)	(142-171)
Absolute Twin-Singleton difference	288.5	192.7	144.0	129.3
Twin Singleton Ratio	7.5	5.7	4.9	5.7
(95% CI)	(7-8.1)	(5.2-6.3)	(4.1-5.7)	(5.4-6.1)
Share of Twins in Neo-Natal Mortality	9.8	7.8	6.9	8.6
(95% CI)	(9.1-10.4)	(7-8.4)	(5.8-8)	(8.1-9)

The neonatal mortality rates for singletons and twins for the four rounds of NFHS conducted over 1992-93 to 2015-16 are presented in table 2. A decline in neonatal mortality for both the groups is observed. The neonatal mortality among singletons declined from 44.1 per 1000 live births (95 % CI: 42-46.1) in 1992-93 to 27.2 per 1000 live births (95 % CI: 26.3-28.1) in 2015-16. Among twins, the neonatal mortality rate declined from 332.5 per 1000 live births (95% CI: 292-373.1) to 156.5 per 1000 live births (95% CI: 142-171) over the same period. Since 1992-93 the reduction in neonatal mortality in absolute terms among twins (176 deaths per 1000 live births) is comparatively higher than for singletons (16.9 per 1000 live births). In relative terms, the reduction in neonatal mortality among twins is lower (53 per cent) as compared to singletons (38 per cent).

The difference in neonatal mortality between twins and singletons has declined consistently from 288.5 deaths per 1000 live births in 1992-93 to 129.3 per 1000 live births. Although, the ratio of neonatal deaths among twins to neonatal deaths among singletons has declined from 7.5 (95% CI: 7-8.1) in NFHS-1 to 4.9 (95% CI: 4.1-5.7) in NFHS-3, recently a jump of 0.8 points in NFHS-4 is estimated. Similarly, the share of twin mortality in total mortality showed a decline from 9.8 per cent (95% CI: 9.1-10.4) in NFHS-1 to 6.9 per cent (95% CI: 5.8-8) in NFHS-3. But, in NFHS-4 the share of twins in neonatal mortality has increased to 8.6 per cent (95% CI: .8.1-9).

Discussion

At present, there are no studies for India which estimate the neonatal mortality among twins using data from all the four rounds of NFHS. Although neonatal mortality rate has come down over the last 25 years, half a million neonatal deaths are still reported annually in India. Our analysis indicate that the percentage of twin births have been gradually increasing over time. The proportion of twin births taking place in rural areas is higher as compared to urban areas. But the number of twin births taking place in urban areas is increasing gradually. The ratio of neonatal deaths among twins to singletons is approximately 6 in 2015-16. And, the share of neonatal deaths among twins in total neonatal deaths is 8.6 (2015-16).

The increase in number of twin births could be due to the use of assisted reproductive technologies and increase in maternal age. Notably, across all the four rounds of NFHS it has been observed that a higher proportion of twins who are born at private facility are male (results not reported here). Additional efforts are required to understand this pattern. One explanation could be sex selection of the child due to pressure from the parents. Also, the neonatal mortality rate among female child is much lower than male child for both singletons as well as twins clearly indicating a biological advantage. Therefore, if the number of male births is higher, it could translate in higher mortality burden.

Our results (not reported here) indicate strong association between neo-natal mortality and certain socio-economic characteristics. The odds of child surviving more than 28 days are lower if the households lie on a lower socio-economic platform. The chances of survival of the second of the twins are very low are indicated by a very high odds ratio. Wealth and education are important determinants of neo-natal mortality. Neonates belonging to higher quintiles and educated mothers have higher chances of surviving after 28 days. The odds of survival of male child are less as compared to females. And, the chances of survival are less in case surgery is not performed for delivery.

With advancement in technology and increase in maternal age at birth, the number of twin births is expected to increase. Coverage of key interventions which are tailored according to needs of different groups and quality of services need to improve to achieve the SDGs by 2030.

Limitations

There are a few limitations to our study. First, it is well documented that the number of twin births reported in DHS is an underestimate since if one of the twins die at birth, the information for only the remaining child is entered and is treated as singleton. Also, since there is no information about use of assisted reproductive technology in data, it is not possible to ascertain the main reason for increase in twin births. Another shortcoming of the DHS data is the presence of recall bias.