

An investigation of spatial determinants of the birth size of child in the last two decades in India

Background

Low Birth Weight (LBW) is a significant public health problem globally; the prevalence has been consistently higher in Southasian and Sub-Saharan countries in the last decade. It is estimated that more than 20 million births (15-20% of all births) are LBW in the world in 2014. There is a significant variation in the prevalence of LBW across and within countries. It varies from 28% in South Asia and 13% in Sub-Saharan Africa to 9% in Latin America. In particular, 30-35% of births are full-term LBW in India. The country alone contributes to 40% of LBW births in all developing countries and nearly half of those born in Asia.

The recent National Family Health Survey-4 (NFHS-4) estimates suggest that the prevalence of LBW varies from the lowest 6% in Mizoram to the highest 27% in Delhi 2015-16 in India. India consists of 28 states and 8 union territories (UT), and clearly, there is a significant within and between states variation in the prevalence of LBW. On the other hand, the classical demographic, clinical, epidemiological studies examining prevalence and risk factors of LBW have majorly focused on bio-demographic individual risk factors and completely ignored a geographical space as an independent factor affecting levels and determinants of LBW in India.

It is noteworthy that there is evidence in developed countries suggesting linkages between LBW and geographical space, and these studies also identified factors affecting the spatial pattern of LBW. Given the complete dearth of studies examining spatial patterns and associated factors of LBW, the present study aims to examine the clustering of birth size and to investigate the potential effect of geographical areas on birth size after adjusting for socioeconomic and demographic risk factors in the last two decades in India. Many research studies have suggested 'birth size of child' is a relatively good indicator of 'birth weight' in underdeveloped and developing countries, including India, where reliable, accurate and complete data of 'birth weight' is not available.

Materials and Methods

The study is cross-sectional and based on the data from the first, second, and fourth rounds of a nationally representative population-based cross-sectional National Family Health Survey (NFHS) conducted in 1992-93, 1998-99, and 2015-16 respectively in India (Demographic and Health Surveys (DHS) are known as NFHS in India). The analysis in the study includes only the youngest under-five live and singleton children born in the reference time of the respective rounds of the survey.

In the study, the outcome variable is 'birth size of child.' To get details about the birth size of child in NFHS, mothers of children below age five years are asked, "When (NAME) was born, was (he/she) very large, larger than average, average, smaller than average, or very small?" The response categories to this question are 'very large,' 'larger than average,' 'average,' 'smaller than

average,' 'very small,' and 'don't know.' The outcome variable 'birth size of child' has two categories. The responses 'smaller than average' and 'very small' are combined as 'smaller than average.' The other responses are combined as 'average and larger.' Finally, the outcome variable is 'prevalence of smaller than average birth size' in the study.

The study analyzed the spatial clustering and associated risk factors by applying Moran's I, univariate and bivariate local indicators of spatial association (LISA), and spatial regression in 74 natural zones. Further, the study utilized female illiteracy (%), unplanned pregnancies (%), less than four antenatal care (ANC) visits (%), use of unimproved toilet facilities (%), use of solid cooking fuels (%), and poverty (%) in natural zones as exposure variables.

Major Findings

The trends suggest a gradual decline in the prevalence of smaller than average birth size during the last two decades in India. The overall prevalence declined from 22% in 1992-93 to 13% in 2015-16, but with significant regional disparities hidden below national and state-level average. The prevalence of smaller than average birth size was higher than 20% in 48 regions in 1992-93 while 8 regions in 2015-16.

The univariate LISA results for the prevalence of smaller than average birth size indicate that the high-high clustering of smaller than average birth size was observed in western and south-western India in 1992-93, in south-western and central India in 1998-99 and north-eastern India in 2015-16. The univariate Moran's I of the prevalence of smaller than average birth size increased from 0.333 in 1992-93 to 0.456 in 2015-16.

The results of the spatial error model report that unplanned pregnancies (%) and use of solid cooking fuels (%) were significantly and positively associated with the prevalence of smaller than average birth size in all three survey rounds. The use of unimproved toilet facilities (%) showed inconsistent association with prevalence of smaller than average birth size. It was significantly associated with a smaller than average size in the first and fourth survey rounds.

Conclusion

This study is the first, perhaps, to investigate the spatial determinants of smaller than average birth size in the last two decades in India. The study uses three rounds of data from large-scale nationally representative population-based NFHS for this purpose. There is a striking shift in the high-high clustering of the prevalence of smaller than average birth size during 1992-93 and 2015-16. An increase in the univariate Moran's I suggests a spatial correlation in smaller than average birth size increased over time. The natural zones characterized by a higher percentage of unplanned pregnancies, use of unimproved toilet facilities and use of solid cooking fuels are also characterized by a higher prevalence of smaller than average birth size. The significant reduction in the prevalence of smaller than average birth size can be achieved through the programs and interventions addressing the unplanned pregnancies, use of unimproved toilet facilities and use of solid cooking fuels in India.