Research Square

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Estimation of Prevalence and Factors Associated with Low Birth Weight in Aspirational Districts of India

Anmol Rai
Asian Development Research Institute
Saurabh Kumar
Piramal Swasthya Management and Research Institute
Shivam Kumar Sharma
Piramal Swasthya Management and Research Institute
Ayush Vardhan
International Institute of Health Management Research (IIHMR)
Nikhil Kumar
Piramal Swasthya Management and Research Institute
Sumant Swain
sumant@iihmrdelhi.edu.in

International Institute of Health Management Research (IIHMR)

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Abstract

Background:

Low birth weight (LBW) is a birth weight that is below 2,500 g, which is a serious issue that affects the whole healthcare, and it is one of the top reasons of morbidity and mortality of newborns in the world. India is a major burden on the world with a significant part of it being in socioeconomically poor areas like Aspirational Districts. The objective of this study was to estimate prevalence of LBW and discuss how far it is related to maternal characteristics, in these districts.

Methods:

The present research relies on secondary analysis of the data of the National Family Health Survey-5 (NFHS-5, 2019-21), the cross-sectional survey that covered the whole country and was carried out on the national level. It was analysed on 26,042 women 15 to 49 years of age living in Aspirational Districts with most recent single institution live birth and a registered birth weight. LBW was defined as < 2500 g. Just the survey-weighted descriptive statistics, chi-square tests, and multivariate logistic regression analysis were performed using version 9.4 of the SAS taking into consideration clustering, stratification, and sampling weights. Results:

Results:

The prevalence of LBW was 17.3%. The odds were found to be higher in younger mothers (1524 years), women in low wealth quintile, less educated women underweight women, and anaemic women and pregnancy complications. Weighted scale: Adequate antenatal care (4 or more visits) and high maternal BMI had low odds. There was geographic difference between districts.

Conclusion:

Aspirational Districts still suffer LBW. Results show a correlation with maternal socioeconomic and maternal health factors. Since it was cross-sectional in nature, interpretation of the results is expected to be correlational. Enhancing maternal nutrition and fair access to antenatal care could be used to decrease LBW.

Introduction

Low birth weight (LBW) or birth weight below 2500g regardless of gestational age, is both a sign of maternal and infant health and a significant factor in infant survival (1). It is an indicator of maternal health status, as well as the quality of care in pregnancy, and beyond because it constitutes an important population-level indicator of health system level. LBW is recognized as a significant societal issue in the world, especially in the low- and middle-income countries (LMICs), where maternal and neonatal morbidity and mortality are disproportionately high as a burden (2, 3). It is predicted that about 20 million LBW infants are being born annually showing almost 15–20 percent of the total live births in the world (3, 4). LBW is among the primary causes of neonatal mortality, and it has been found that LBW is the main cause of all neonatal deaths in the world, which is nearly 60–80 percent of all infant deaths (5, 6). Low-weight babies have greater risks of inducing short-term problems including respiratory distress, hypothermia, infections and feeding problems that increase the risks of the early death considerably (3, 5). In addition to neonatal effects, the LBW has been reported to have long-term negative outcomes, such as cognitive development, lower educational attainment, and higher risk of developing non-communicable diseases (type 2 diabetes, hypertension, and cardiovascular diseases) in adulthood (7, 8). Such long-term outcomes demonstrate why LBW must be addressed as a clinical issue as well as a larger public health concern. This distribution of LBW burden is uneven as most of the cases are in LMICs. In South Asia, and especially in the region, the level of prevalence is among the highest in the world due to the combination of maternal malnourishment, socioeconomic inequality, and insufficient access to the quality medical services (2, 9). However, India alone carries a large burden of the burden globally, with national estimates stating that there is a steadfast percentage of 18.2 indicating that the number of births is below the standard of low birth weight, according to the National Family Health Survey-5 (NFHS-5, 2019-21) (10). Despite improvement this has occurred, though at a slow pace, unevenly, as structural inequalities in health and nutrition have remained in place.

LBW has been demonstrated to be aided by a substantial number of determinants, which include maternal, socioeconomic, and healthcare related factors. Age of the mother is also a significant biological factor with younger mothers especially adolescents who are at a greater risk because their bodies are still developing and their nutritional competition between the mother and foetus is greater (11–13). The socioeconomic status is usually assessed by measuring wealth index or income, and it is determined to have numerous avenues to LBW, such as the access to proper nutrition, healthcare facilities, and conditions to live (9, 14). The poorer women have a higher likelihood of food insecurity, low dietary nutritional intake, and access to low-standard maternal health, which result in poor birth outcomes. Mother education has also been a constant relationship with LBW. Women who have gone through education will embrace proper health practices, use antenatal care services, and better nutrition practices throughout pregnancy(14, 15).

Education is also a contributor to health literacy so that women would know the complications during pregnancy and be able to get immediate medical attention. Nonetheless, education tends to have an interplay with other more socioeconomic influences and therefore education is not only its own determinant but also a proxy of social advantage. The most significant birth weight determinants include maternal nutritional status. Underweight women experiencing low body mass index (BMI) during or prior to pregnancy are in risk of giving birth to low weight babies because of poor nutritional stores and poor placental functioning (16, 17). Micronutrient deficiency especially of iron, folate and zinc also causes limited foetal growth. Maternal anaemia which continues to be one of the most prevalent in India has been linked to a decreased oxygen uptake by the unborn baby, as well as high risk of poor birth outcomes (18, 19). Although national programs are aimed at the reduction of anaemia, its presence in the country continues to be a major challenge. The use of ANC is significant in enhancing the outcome of the pregnancy through offering a chance to detect and manage pregnancy complications in early stages, nutritional supplements, and health education. It has been demonstrated that poor ANC correlates with risks of developing LBW (11, 12). Nevertheless, there is new evidence indicating that quality and content of ANC services can be of importance rather than the number of visits itself. Poor continuity of care, inadequate screening and suboptimal counselling may hinder the effectiveness of ANC to enhance the outcomes of birth. Another factor contributing to LBW is pregnancy complications such as hypertensive disorders, infection and gestational conditions. These may affect the placental functioning and foetal development that results in intrauterine growth retardation and preterm delivery. It is the interplay of maternal health, nutritional status, and the ability to obtain healthcare that exacerbates the mechanisms of LBW; therefore, the struggle of the issue is multifactorial. Other structural and contextual factors including caste, geographic setting and rural urban differences contribute greatly to maternal and child health in India besides individual level determinants. The disadvantages that many women in marginalized social groups must bear are usually compounded, such as low access to healthcare services, discrimination, and substandard living conditions (9). In rural communities specifically, poor health care facilities, lack of trained health care providers, and impediments to availing maternal healthcare services characterize the areas. Appreciating these differences, the Government of India initiated in 2018 the Aspirational Districts Programme (ADP), which aims to rapidly boost development in 112 poorly performing districts on the level of the most important areas, such as health and nutrition (20). These areas are set according to their poor score of development indicators and are put on the list of places of special interventions and observations. The main goal of the programme is to improve the outcomes of the work of the health care systems, both maternal and child health. Nonetheless, such districts still must struggle with the issues of high poverty rates, under-feeding and poor access to healthcare. Although the ADP is a policy important policy, the burden and determinants of

the LBW in Aspirational Districts are poorly surveyed. Majority of the current literature has concentrated on national or state-level estimates and this could obliterate the trends of significant subregion differences and determinants in specific contexts. Knowledge about the patterns and correlates of LBW in Aspirational Districts is crucial to the proposed solution of creating interventions aimed at LBW and informing policymaking. Besides, although big data surveys like NFHS-5 are valuable to study the trends at a population-level, the cross-sectional characteristic of big data restricts the opportunity to determine causal associations. However, this kind of data is essential to determine high-risk groups and inform the evidence-based approaches to the community. Hence, the objective of the study will be to determine the prevalence of low birth weight and investigate its relationship with socioeconomic and health-related factors of the mother in Aspirational Districts of India based on nationally representative NFHS-5. This study aims to offer context-specific evidence to affirm current activities of enhancement of maternal and child health outcomes in India by addressing development-priority districts.

Methods

Study design and data source

The given research is founded on the secondary analysis of data available in the National Family Health Survey-5 (NFHS-5), which took place in 2019–2021 (10). The NFHS-5 is a household survey that is conducted nationally on behalf of the Ministry of Health and Family Welfare, government of India and coordinated by the International Institute for Population Sciences (IIPS), Mumbai. The survey was done on a multistage stratified cluster sampling design to promote representativeness in national, state, and district spheres. As primary sampling units (PSUs) in rural and census enumeration block (CEBs) in urban areas, villages and blocks were used, respectively. The households were randomly selected using a systematic sampling technique within a PSU. NFHS-5 surveyed 724,115 women (age 15–49 years old) on their demographic features, socioeconomic status, maternal health, and child health and nutritional status by greater than 95 percent response rate.

Study population and sample selection

The current study targeted women living in districts that were affected under the Aspirational Districts Programme (ADP). Respondents in those districts were identified through a set of district identifiers that were found in the NFHS-5 dataset. The analytic sample was limited among the women between the ages 15–49 years with the most recent live birth of less than five years before the survey. The analysis was further uniquely constrained by births and institutional deliveries where the birth weight was recorded by

use of written health cards or maternal recall to enhance the measurement accuracy and minimize the level of bias.

They included 26,042 women in the final analysis sample after the use of these inclusion criteria.

Outcome variable

Low birth weight (LBW) was the main outcome measure, which was defined as a birth weight below 2,500 grams of weight in line with the World Health Organization criteria (1). Information on birth weight in NFHS-5 was reported on written health records where they were available or maternal recollection where available.

The outcome variable was coded in terms of binary indicator:

- 1 = Low birth weight (< 2500 g)
- 0 = Normal birth weight (≥ 2500 g)

Independent variables

The independent variables were assigned on the basis of the previous testing outcomes on the factors which determine the low birth weight in India and in other low- and middle-income countries (11, 12). The following variables were divided into three domains:

Socioeconomic and demographic characteristics

The age of the mothers was divided into 15–24 years, 25–34 years, and = > 35 years of age. There were the marginalized (Scheduled Castes/Scheduled Tribes) and non-marginalized (Other Backward Classes/General) types of caste. Religion was categorized as Hindu, Muslim, Christian and others. The household wealthy status was identified by using NFHS wealth index, which was grouped into low, middle, and high. Other variables were place of residence (rural/urban), employment (employed/not employed), marital status and maternal education (illiterate/literate).

Service utilization variable

The use of antenatal care (ANC) was sorted according to the number of visits, less than four visits and four or more visits in accordance with the WHO guidelines.

Maternal health-related characteristics

Body mass index (BMI) was used to determine the maternal nutritional status as; underweight (< 18.5 kg/m2), normal (18.5–24.9 kg/m2), overweight (25-29.9 kg/m2), and obese (> = 30 kg/m2). Haemoglobin was used to define anaemia status as anaemic or non-anaemic. The interviewee's birth interval was divided into less than 24 months and 24 months and above. One binary variable (yes/no) was pregnancy-related complications. The recoding was done on all variables using NFHS standard coding scheme.

Statistical analysis

SAS version 9.4 was used to do all statistical analyses. The distribution of the maternal characteristics was summarized with the help of descriptive statistics that allowed estimating the prevalence of low birth weight. The results are given in percentage based on the survey and with a 95% confidence interval. The survey-adjusted chi-square tests were employed to determine the bivariate relationships between low weight and bivariate explanatory variables as this was a complex sampling study. The analysis took place on multivariable binary logistic regression with the help of PROC SURVEYLOGISTIC to estimate adjusted odds ratios (AORs) and 95% confidence intervals. The regression model had all the relevant socioeconomic, demographic, and maternal health variables on theoretical and empirical grounds.

Key methodological specification:

The analyses took into consideration all the complex survey design, sampling weights, clustering and stratification. The association estimates that were made with low birth weight were all based on models that were survey-weighted based on clustering and stratification to make the correct one at population level. The p-value of statistical significance was set at less than 0.05.

Interpretation of findings

Since the NFHS-5 data was cross-sectional, the findings obtained in the present study cannot be taken as causal relationships but as correlational. The analysis has found that there is a significant relationship between maternal characteristics and low birth weight; however, it does not discover the pathways of time and causation.

Ethical considerations

NFHS-5 data is transparent and anonymized (10).

Results

The number of women involved was 26,042. Most of them (54.1) were aged 25–34 years and 83.1 were in the rural areas. A good percentage of them fell into lower wealth category (61.3%). Undernutrition among the maternal population was rampant (25% underweight), and 64.7% of the female population had anaemia. About 51.64% of them had four or above antenatal care visits. The prevalence of LBW was 17.3% (95% CI: 16.8–17.8).

Table 1
Socio-demographic and Maternal Health Characteristics of Respondents (Survey-Weighted), NFHS-5, 2019–21

Variable	Category	n	Weighted %	95% CI
Maternal age (years) (N = 26042)	15–24	9255	37.64	36.88–38.40
	25–34	14338	54.11	53.36–54.86
	≥ 35	2449	8.24	7.83–8.65
Caste (N = 24519)	Non-marginalised	13297	61.60	60.48–62.72
	Marginalised	11222	38.40	37.28–39.52
Religion (N = 26042)	Hindu	19819	79.65	78.58–80.72
	Muslim	3993	16.08	15.05–17.11
	Christian	1270	1.88	1.63–2.13
	Others	960	2.39	2.13–2.65
Wealth index (N = 26042)	Low	16350	61.25	60.30–62.20
	Middle	4483	17.10	16.43–17.77
	High	5209	21.65	20.88–22.42
Residence (N = 26042)	Rural	22380	83.10	82.27–83.93
	Urban	3662	16.90	16.08–17.72
Education (N = 26042)	Illiterate	9014	35.25	34.37–36.13
	Literate	17028	64.75	63.87–65.63
Employment status (N = 3968)	not employed	2957	77.80	76.07-79.5414
	employed	1011	22.19	20.45–23.92
Marital status (N = 26042)	Never in union	51	0.12	0.08–0.17
	married	25662	98.80	98.62–98.97
	widowed	187	0.63	0.52–0.74
	divorced	34	0.086	0.03–0.14
	separated	108	0.36	0.27–0.46
BMI (N = 26042)	Underweight	6304	25.00	24.29–25.71
	Normal	16458	61.72	60.96–62.48

Variable	Category	n	Weighted %	95% CI
	Overweight	2599	10.47	9.97–10.97
	Obese	681	2.82	2.54–3.10
ANC visits (N = 25836)	< 4 visits	11416	48.45	47.42–49.48
	≥ 4 visits	14420	51.55	50.51–52.59
Anaemia (N = 25251)	Not anaemic	8868	35.31	34.49–36.13
	Anaemic	16383	64.69	63.88–65.50
Birth interval (N = 17223)	< 24 months	4025	26.13	25.23–27.03
	≥ 24 months	13198	73.87	72.97–74.77
Pregnancy complications (N = 26042)	No	8845	33.27	32.36–34.18
	Yes	17197	66.73	65.83–67.63
Low birth weight (N = 26042)	No	21538	82.63	82.02–83.24
	Yes	4504	17.37	16.76–17.98

Table 2
Stratified Result Table Between Maternal Characteristics and Low Birth Weight

Variable	Category	LBW (n)	% (95% CI)	χ^2 value	p-value
Age (years)	15–24	1770	19.26 (18.26–20.26)	39.20	< 0.0001
	25–34	2344	16.25 (15.44–17.06)		
	≥ 35	390	16.07 (14.26–17.87)		
Caste	Non-marginalised	2206	16.54 (15.71–17.37)	19.52	0.0008
	Marginalised	2042	18.74 (17.76–19.71)		
Religion	Hindu	3547	17.54 (16.85–18.22)	6.68	0.1578
	Muslim	655	16.46 (14.93–17.99)		
	Christian	129	15.15 (11.95–18.35)		
	Others	173	19.62 (16.49–22.75)		
Wealth-index	Low	3054	18.75 (17.98–19.52)	55.59	< 0.0001
	Middle	678	15.61 (14.27–16.95)		
	High	772	14.85 (13.59–16.11)		
Residence	Rural	3900	17.50 (16.85–18.15)	1.46	0.4202
	Urban	604	16.74 (15.04–18.44)		
Employment status	Not employed	462	16.45 (14.80–18.10)	6.14	0.0433
	Employed	194	20.03 (16.84–23.21)		
Marital status	Never in union	10	18.11 (5.62–30.60)	5.04	0.2762
	Married	4441	17.41 (16.80–18.03)		
	Widowed	35	15.52 (9.74–21.31)		

	Divorced	5	14.00 (0.00–28.50)		
	Separated	13	9.19 (3.50–14.87)		
Education	Illiterate	1779	20.01 (18.96–21.07)	69.05	< 0.0001
	Literate	2725	15.93 (15.21–16.65)		
BMI	Underweight	1309	20.62 (19.33–21.90)	91.20	< 0.0001
	Normal	2770	16.93 (16.18–17.67)		
	Overweight	332	12.90 (11.32–14.47)		
	Obese	93	14.89 (11.40–18.38)		
ANC visits	< 4 visits	2054	17.86 (16.97–18.74)	4.92	0.0812
	≥ 4 visits	2405	16.81 (16.00–17.63)		
Anaemia	Not anaemic	1453	16.63 (15.65–17.61)	4.07	0.0984
	Anaemic	2904	17.64 (16.88–18.39)		
Birth interval	< 24 months	706	17.09 (15.71–18.47)	3.70	0.1174
	≥ 24 months	2084	15.86 (15.05–16.67)		
Pregnancy complications	No	1368	15.59 (14.64–16.54)	28.58	< 0.0001
	Yes	3136	18.26 (17.49–19.02)		

The study looked at how different factors related to mothers were associated with low birth weight (LBW) in infants. It was found that the mother's age, wealth quintile, education, residence type, BMI, and pregnancy complications were significantly linked to LBW ($P < 0.05$). However, factors like caste, religion, employment status, marital status, ANC visits, anaemia, and birth interval did not show a significant association with LBW.

A higher prevalence was observed among younger mothers aged 15–24 years, those belonging to poorer households, and illiterate women. Additionally, the prevalence was greater among women who had fewer than four antenatal care (ANC) visits. It was also found to be higher among anaemic and underweight women, as well as among those who experienced pregnancy-related complications. Furthermore, a higher prevalence was noted among women with a birth interval of less than 24 months.

Table 3
Multivariable Binary Logistic Regression of Factors Associated with Low Birth Weight

Variable	Category	AOR	95% CI	p-value
Age (ref: 15–24)	25–34	0.82	0.75–0.90	< 0.001
	≥ 35	0.77	0.66–0.90	0.001
caste (ref: non-marginalised)	marginalised	1.074	0.97–1.19	0.1583
Religion (ref: Hindu)	Muslim	0.975	0.86–1.13	0.7289
	Christian	0.837	0.64–1.09	0.1916
	others	1.183	0.96–1.46	0.116
Wealth (ref: Low)	Middle	0.88	0.78–0.99	0.04
	High	0.86	0.76–0.98	0.02
Education (ref: Illiterate)	Literate	0.77	0.71–0.85	< 0.001
Residence (ref: Rural)	Urban	1.15	1.00–1.32	0.049
employment status (ref: non-employed)	employed	1.17	0.91–1.49	0.23
marital status (ref: never in union)	married	0.994	0.44–2.27	0.99
	widowed	0.851	0.33–2.18	0.74
	divorced	0.595	0.12–2.89	0.52
	separated	0.468	0.16–1.39	0.17
BMI (ref: Underweight)	Normal	0.81	0.74–0.89	< 0.001
	Overweight	0.66	0.56–0.78	< 0.001
	Obese	0.76	0.56–1.03	0.07
ANC (ref: <4)	≥ 4 visits	0.99	0.91–1.08	0.82
Anaemia (ref: No)	Yes	1.03	0.94–1.13	0.52
Birth interval (ref: <24)	≥ 24 months	0.95	0.84–1.06	0.34
Pregnancy complications (ref: No)	Yes	1.22	1.12–1.34	< 0.001

Table 3 displays the adjusted odds ratios (AORs) of factors related with low birth weight (LBW) estimated by a survey-weighted multivariable logistic regression model that considered the possible confounding effect of sociodemographic and maternal health-related variables. The estimates have been generated by adjusting age of mother, caste,

religion, wealth index, place of residence, education and body mass index as a result of previous literature review. LBW was significantly associated with the maternal age, wealth index, education, residence place, body mass index and pregnancy complication at P-value less than 0.05.

Women aged 25–34 years (AOR: 0.82, 95% CI: 0.75–0.90) and those aged > 35 years (AOR: 0.77, 95% CI: 0.66–0.90) had significantly lower odds of delivering LBW infants compared to women aged 15–24 years. Women who were literate (AOR: 0.77, 95% CI: 0.71–0.85) and belong to middle (AOR: 0.88; 95% CI: 0.78–0.99) and higher wealth status (AOR: 0.86; 95% CI: 0.760.98) group had significantly lower odds of having LBW infants as compared those women who are illiterate and belong to lower wealth status.

Another significant association was seen with place of residence as those women who belongs to urban area (AOR: 1.15, 95% CI: 1.00-1.32) had higher odds of having LBW infants as compared to those women who resides in rural area.

Maternal nutritional status also proved as an independent determinant of LBW. Women with normal BMI (AOR: 0.81; 95% CI: 0.74–0.89) and overweight BMI (AOR: 0.66; 95% CI: 0.56–0.78) were found to have significantly lower chances of giving birth to LBW babies compared to underweight women. The association between the obese women and LBW was not significant (AOR: 0.76; 95% CI: 0.56–1.03), Pregnancy-related complications were considerably correlated with high odds of LBW (AOR: 1.22; 95% CI: 1.12–1.34), which implied that the risk was higher in the presence of pregnancy-related complications among women. Whereas some factors like caste, religion, employment status, 4 or more Anc visits, anaemia and birth interval were not significantly associated with LBW.

Geographic variation

Map Interpretation:

The map visually represents the prevalence of low birth weight (LBW) children across India’s Aspirational Districts, using a color-coded scheme to denote varying levels of prevalence. Districts are categorized into five groups based on the percentage of LBW children:

- ≤ 5% (dark green)
- 6–10% (light green)
- 11–15% (yellow)
- 16–20% (orange)
- ≥ 21% (red)

A noticeable spatial disparity in LBW prevalence is evident across the country. High-burden districts (colored in red, indicating ≥ 21% LBW prevalence) are prominently concentrated in central, eastern, and parts of southern India, particularly in states such as Bihar, Madhya Pradesh, Chhattisgarh, Odisha, and Maharashtra. These regions also coincide with areas characterized by socio-economic deprivation, limited access to quality healthcare, and poor maternal nutrition.

In contrast, several districts in northeastern India and some parts of northern India (notably in Jammu & Kashmir and Himachal Pradesh) show relatively low prevalence (≤ 10%), suggesting regional variation in healthcare access, nutritional practices, and maternal health services. The clustering of high-prevalence districts in specific zones indicates a potential need for region-specific interventions. These may include strengthening maternal health services, improving antenatal care coverage, addressing food insecurity, and community-based awareness programs.

This map underscores the critical need for targeted policy attention and resource allocation in the most affected districts. It also serves as a valuable tool for identifying priority areas where maternal and child health programs must be intensified to reduce the burden of low birth weight and associated health risks.

Discussion

This paper presents detailed evidence on the prevalence and determinants of low birth weight in Aspirational Districts of India on nationally representative data. The LBW (17.3) prevalence in this study is like the national estimates in NFHS-5 which points out to the fact that despite the directed policy efforts, LBW has continued to be a public health issue in the development-prioritizing districts (10, 11).

Socioeconomic inequalities

The results indicate that there is a vivid socioeconomic gradient of LBW with more prevalence in poor women and less educated women. The findings are in line with other researches carried out in India and other developing nations (11, 12). The socioeconomic disadvantage has a variety of mechanisms on the birth outcomes, among them being poor maternal nutrition, poor living conditions, and insufficient access to quality healthcare services (9, 14). Education of the mothers, especially, turned out to be a potent preventive measure. The educated women are more likely to use the amenities of the antenatal care, make the right food choices and healthcare services, which are all leading to better birth statistics. Nonetheless, education can also serve as a surrogate of greater socioeconomic benefits, and the independent impact should be viewed with discretion of mothers and their nutritional status. One of the most influential predictive factors of LBW in this study

was the maternal nutritional status. The odds of childbearing underweight women producing LBW babies were much greater, which is in line with the current research that maternal undernutrition is a risk factor of intrauterine growth restriction (16, 17). Poor maternal nutritional reserves may impair placental function, leading to inadequate fetal development and resulting in adverse birth outcomes. Surprisingly, the common women with normal and higher BMI had reduced odds of being underweight as opposed to women who were of LBW. Although this result indicates that adequate nutritional status protects, it cannot be construed that overweight or obesity is good because there are other negative pregnancy outcomes which have been linked to higher BMI, which include gestational diabetes and hypertensive disorders.

Pregnancy complications

Problems with pregnancy were also highly correlated with higher odds of LBW. This observation is in line with clinical facts, with which complications like hypertension, infections, and other gestational conditions may negatively impact foetal development and expose the foetus to the risk of being born with low birth weight. These findings show the significance of antenatal care services in identifying and managing pregnancy complications in the initial stages.

Antenatal care and anaemia

Unlike in other studies which have been done in the past, there was no significant relationship between LBW and the use of antenatal care as well as anaemia adjusted. This finding suggests that the quality, timing, and content of antenatal care may be more critical than the number of visits alone, particularly in resource-constrained settings. Possible explanation of lack of association between anaemia and LBW is the limit of measurement, residual confounding or complex interaction between various factors that have an effect on determining the birth weight. As the level of anaemia among women in India is very high, it is a significant public health concern that should be given more attention.

Urban–rural and geographic variation

The randomness of the tendency of LBW to be a little higher in the urban population can be attributed to the increased weight of urban poverty, overcrowding and other environmental pressures in urbanizing central cities. This observation creates the necessity of handling intra-urban disparities in the health of the mother. The visual geographic difference in the prevalence of LBW within Aspirational Districts clearly shows the significance of interventions in particular contexts. These disparities are probably driven by differences in socioeconomic development, infrastructure of healthcare and program implementation (20, 21).

Policy implications

The policy and program design implications of the findings of this study would be significant in Aspirational Districts. The intervention types should focus on the enhancement of maternal nutrition and the quality of antenatal care delivery, and the socioeconomic disparities. Specific measures aimed at high-burden districts could also be quite effective in limiting the number of cases with LBW.

Interpretation

Results are to be viewed as an association but not a cause because the data used was cross-sectional. The observed associations can also be caused by residual confounding and measurement limitations.

Strengths

The research has several strengths:

1. It uses a substantial, nationwide representative data (NFHS-5) that makes it robust in estimating the population level.

2. The relevance of findings is improved by Focus on Aspirational Districts, which is a subpopulation of interest in terms of policy implications.

3. Complex Survey design features, such as weights, clusters, or strata used in the incorporation, give rigor to methods.

4. The study narrows on those districts under the Aspirational Districts Programme, which offer policy-relevant insights on regions of development priorities, which are not usually adequately reflected in national studies.

Limitation of the study

There are significant limitations of the study are:

1. The cross-sectional study type does not allow making a causal conclusion; no observed relationships can draw a sense of time or a sense of direction.

2. The Recall bias caused by maternal recall data of birth weight could also be a problem with LBW prevalence estimates.

3. The exclusion of women with home deliveries and infants with unmeasured or unknown birth weight may introduce selection bias due to measurement error in home-recorded birth weight, as these groups often belong to socioeconomically disadvantaged populations at higher risk, potentially leading to an underestimation of the true burden.

Conclusion

Low birth weight is a long-standing social health issue in the Aspirational Districts of India that has prevalence rates equivalent to the national estimates but indicative of underlying socioeconomic and health system inequalities. As noted in the current study, maternal under-nutrition, lower socio-economic status, low levels of educational attainment and pregnancy related complications are the important factors that are linked with low birth weight in these development-priority districts. These findings highlight the need to intensify maternal nutrition interventions especially among the undernourished mothers and to treat more social causes of poor health including poverty and education. It is important to enhance the quality and efficacy of antenatal services such as early identification and treatment of pregnancy complications to increase the outcomes of births. Since prevalence of low-birthweight was observed to be geographically different, it is necessary to have specific and even localized interventions in high-burden districts. The decision to strengthen health systems, improve service delivery, and equitable access to maternal healthcare services should be the main focus in the Aspirational Districts Programme policy. Since the analysis is carried out using the cross-sectional data it should be assumed that the results should not be treated as the cause-effect relationships. However, the research offers valuable information to guide the way people should implement health strategies to reduce the low birth weight and enhance maternal and child health outcomes in India. Nationally representative data and even more longitudinal studies should be conducted to see the causal pathways better and assess the efficiency of interventions.

Declarations

Ethical approval:

This is a secondary data analysis and does not require ethical approval for this paper. In accordance with the Declaration of Helsinki, ethics approval was waived by the Institutional Ethics Committee of the International Institute of Health Management Research, New Delhi, India. Informed consent was not obtained.

Consent to participate:

The current study used secondary data; therefore, informed consent of parents to participate was not required.

Data availability statement:

The data that support the findings of this study are available from the corresponding author upon reasonable request.

Competing interests:

The authors declare no competing interests.

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Authorship:

Anmol Rai: Draft writing, review & validation. Saurabh Kumar: Resources, formal analysis, data curation, software and validation. Shivam Kumar Sharma: Conceptualisation, resources, formal analysis and validation. Ayush Vardhan: Formal analysis, draft writing, review & editing, and validation. Nikhil Kumar: Data visualization and validation. Sumant Swain: Conceptualisation, draft writing, review, editing, and validation.

Open-access:

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Author Contribution

Anmol Rai: Draft writing, review & validation. Saurabh Kumar: Resources, formal analysis, data curation, software and validation. Shivam Kumar Sharma: Conceptualisation, resources, formal analysis and validation. Ayush Vardhan: Formal analysis, draft writing, review & editing, and validation. Nikhil Kumar: Data visualization and validation. Sumant Swain: Conceptualisation, draft writing, review, editing, and validation.

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Figures

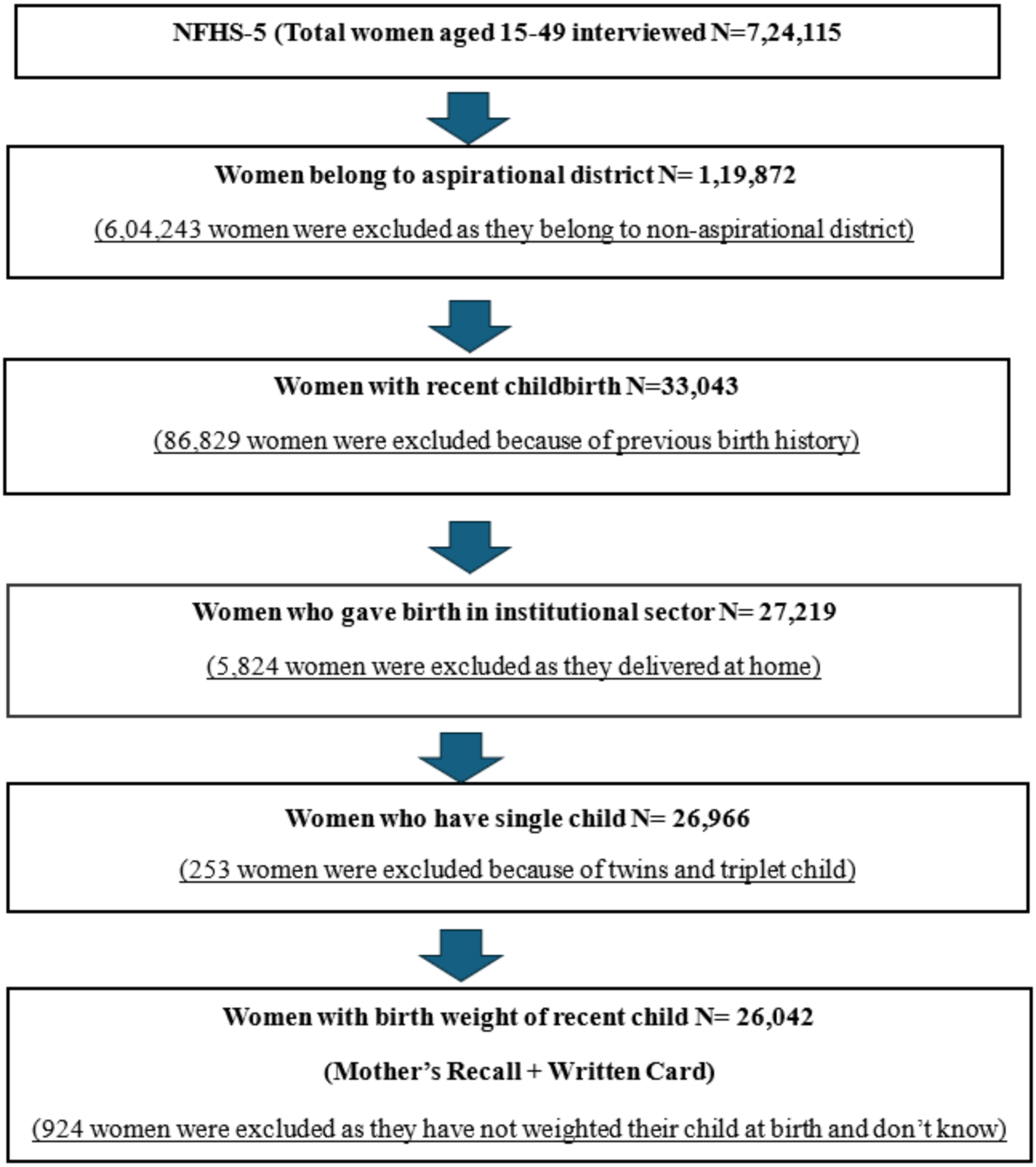


Figure 1

Flow diagram illustrating the selection of the analytic sample.

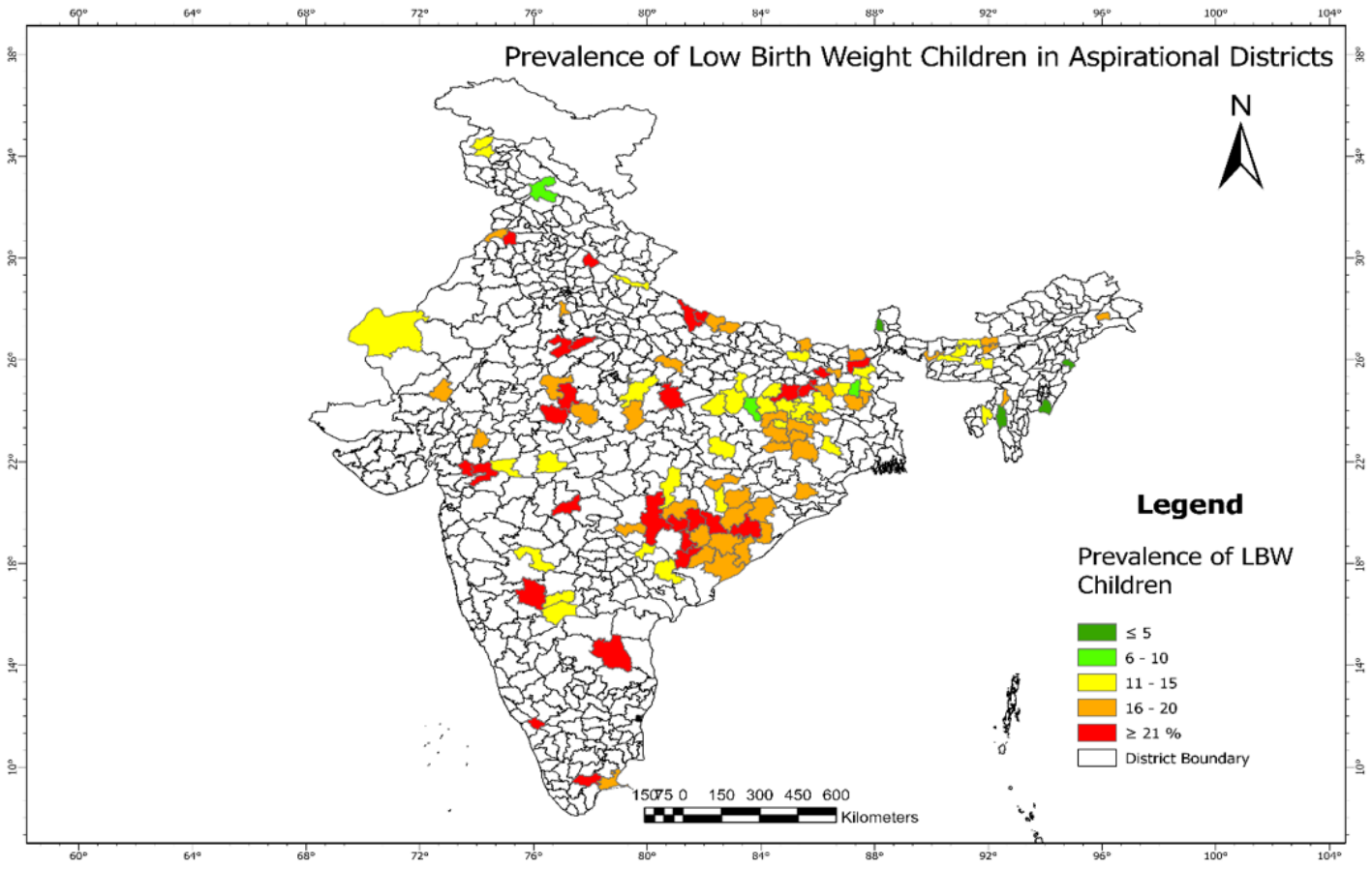


Figure 2

District-Level Prevalence of Low Birth Weight in Aspirational Districts (Descriptive Map)