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# Antenatal Care Utilization and its Impact on Low Birth weight in India: Evidences from NFHS-5

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## ABSTRACT

*Low birthweight (LBW) is a critical public health concern in lower-middle-income countries. Despite various efforts to improve maternal healthcare utilization, universal access to Antenatal Care (ANC) remains a challenge in India. This paper examines the association between ANC utilization and LBW outcomes using data from the fifth National Family Health Survey About 18 percent of the sampled children were born with LBW, and only one-fourth of the women received complete ANC services during this period. The results from logistic regression analysis indicate that the likelihood of LBW was significantly lower among children whose mothers received adequate ANC, even after adjusting for socioeconomic and demographic variables. These findings suggest that expanding access to affordable and quality ANC services can be an effective strategy for reducing LBW incidence. Furthermore, targeted interventions for socioeconomically vulnerable women are essential to improve ANC uptake and combat LBW prevalence.*

**Keywords-** Antenatal Care, Low Birth Weight, Logistic Regression, National Family Health Survey

## INTRODUCTION

Birth weight is widely recognized as a sensitive barometer of maternal and child health because it integrates the effects of intra-uterine growth restriction, prematurity, or both (WHO, 2016). The World Health Organization (WHO) defines low birth-weight (LBW) as a birth weight $< 2500$ g, with further sub-categories of very low birth-weight ($< 1500$ g) and extremely low birth-weight ($< 1000$ g) (UNICEF & WHO, 2004). LBW is a leading risk factor for fetal and neonatal mortality and a major contributor to childhood morbidity worldwide, reflecting long-term maternal malnutrition and inadequate health care during pregnancy (Lawn, Cousens, & Zupan, 2005; Titaley et al., 2008).

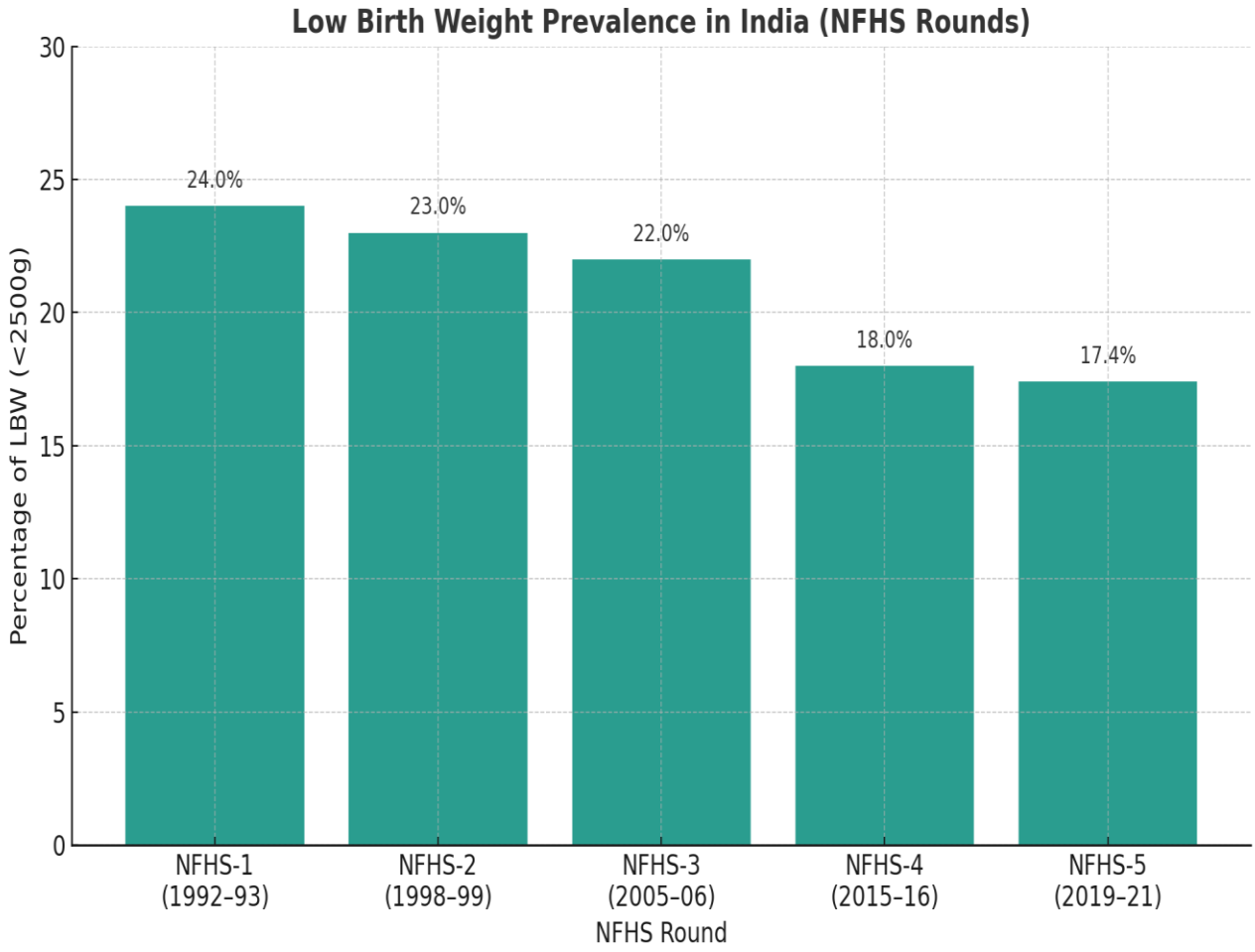
  

ISSN: 2455-8834

Volume:10, Issue:06 "June 2025"

Globally, 20.5 million newborns were born with LBW in 2015, and an estimated 2.5 million infants died within the first month of life in 2017 (UNIGME, 2018; UNICEF & WHO, 2019). Southern Asia accounts for nearly half of these cases, with an incidence of 27 %—the highest in the world. Developing regions collectively contribute 96.5 % of all LBW births (UNICEF & WHO, 2019). In India, although the proportion of LBW decreased from 22 % to 18 % between 2005–06 and 2015–16 (IIPS & ICF, 2017), the latest National Family Health Survey (NFHS-5) still records 17.4 % of children under five born with LBW (Hegde et al., 2023). LBW remains the foremost cause of child mortality, particularly among socio-economically disadvantaged communities (Rai et al., 2017).

**Figure1 Trend of Low Birth Weight (LBW) in India (1992-2021)**



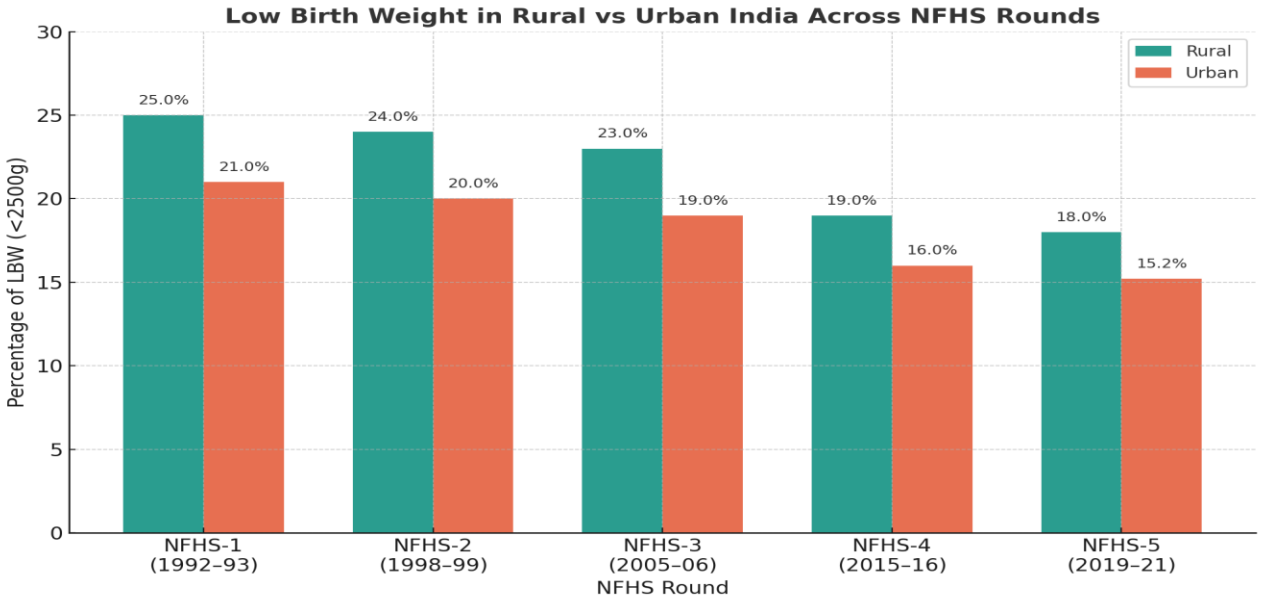

Data Source: International Institute for Population Sciences (IIPS) & ICF, NFHS Reports (1992–2021).

ISSN: 2455-8834

Volume:10, Issue:06 "June 2025"

**Figure 2 Trend of Low Birth Weight (LBW) in India according to the area of residence (1992-2021)**




**Data Source:** International Institute for Population Sciences (IIPS) & ICF, NFHS Reports (1992–2021).

The consequences of LBW extend well beyond the neonatal period. Evidence links LBW with stunting, wasting, delayed organ growth, impaired cognitive development, type 2 diabetes, and a spectrum of chronic morbidities later in life (Risnes et al., 2011; UNICEF & WHO, 2004). Its incidence is shaped by a constellation of socioeconomic, demographic, biological, and environmental factors, including maternal malnutrition, poverty, early age at conception, and restricted health-care access (Carlson, 1984; Kramer, 1987; Mahumud, Sultana, & Sarker, 2017; Neggers et al., 2004; Noureddine & Abdellatif, 2015).

Antenatal care (ANC) is the cornerstone of safe motherhood and primary health care during pregnancy. In 2016 the WHO raised its recommendation from a minimum of four visits to eight ANC contacts to improve maternal, perinatal, and neonatal outcomes (WHO, 2016). ANC encompasses nutritional interventions, maternal and fetal assessments, prophylaxis against infection, and counselling on common physiological concerns to ensure a positive pregnancy experience (Carroli, Rooney, & Villar, 2001; Campbell & Graham, 2006; Chen et al., 2007). Adequate dietary intake and caloric supplementation during pregnancy demonstrably reduce the risk of LBW (Abu-Saad & Fraser, 2010; Dharmalingam, Navaneetham, & Krishnakumar, 2010; Imdad & Bhutta, 2012).

ISSN: 2455-8834

Volume:10, Issue:06 "June 2025"

India has introduced multiple programmes under the National Health Mission to expand ANC coverage—ranging from iron and folic-acid supplementation to regular weight monitoring—with frontline workers such as Accredited Social Health Activists (ASHA), Anganwadi Workers, and Auxiliary Nurse Midwives spearheading village-level outreach (Kapil & Choudhury, 2005; Nagarajan et al., 2015). Despite notable progress, ANC services remain under-utilized among women of low socioeconomic status due to limited accessibility, lack of awareness, and financial constraints (Assefa, Berhane, & Worku, 2012; Asundep et al., 2013; Efendi et al., 2016; Pallikadavath, Foss, & Stones, 2004; Paul & Chouhan, 2019; Rai, Singh, & Singh, 2012; Simkhada et al., 2007; Singh, Rai, & Singh, 2012). Consequently, maternal mortality and adverse birth outcomes persist at disproportionately high levels within impoverished groups.

Current literature has extensively examined the socioeconomic and obstetric determinants of LBW, yet the specific influence of adequate ANC utilization—particularly the newly recommended eight-contact model—on LBW remains under-explored in nationally representative Indian data. Recent NFHS rounds reveal that a considerable share of women still fails to receive even four ANC visits, underscoring a critical gap between policy aspirations and ground realities.

The present study leverages data from NFHS-5 to assess the relationship between the utilization and regulation of ANC services and the incidence of low birth-weight in India. By focusing on the adequacy of ANC contacts and their distribution across socio-economic strata, the research seeks to inform targeted policy interventions to reduce LBW and improve child survival and development outcomes.

## DATA AND METHODOLOGY

The data used in the study is obtained from National Family Health Survey Round 5, Indian Demographic and Health Survey (DHS) conducted during 2019-21. NFHS-5 was conducted under Ministry of Health and Family Welfare (MoHFW), Govt. of India and International Institute for Population Sciences (IIPS). NFHS-5 data was collected from 35 states 7 union territories and 707 districts. Total of 724,115 married women of the age group 15 to 49 have been interviewed for the survey questioned over different socio economic, health and nutrition and biological variables. After cleaning of the data, the total of 126, 995 births in past five years have been considered for the study. To study the socio-economic determinants of Low Birth Weight we have considered the fundamental variables which may affect LBW. These variables include, education of the mother, area of residence, caste, religion and the wealth index of the household. We have selected four measures of ANC services: four or more ANC visits, ANC visit within first trimester, ANC from skilled provider, prenatal doctor visits. Along with these variables we have also considered Anaemia level and supply of nutrition among the pregnant women by

ISSN: 2455-8834

Volume:10, Issue:06 "June 2025"

government. Further in our study, we have used binary logistic regression to analyze the relationship between utilization of ANC services and incidence of LBW among children.

**Table:1 List and code of different socio-economic and ANC Variables considered for the study**

| **Variables under Study** | |
|---|---|
| Variables | Code |
| **Socio-Economic Variables** | |
| Type of Place of Residence (Cat) | V102 |
| Caste (Cat) | S116 |
| Religion (Cat) | V130 Recoded |
| Highest Education level of Mother (Cat) | V106 |
| Wealth Index of Household (Cat) | V190A |
| **Biological and ANC Variables** | |
| ANC visit in 1st Trimester (Binary) | M13 Recoded |
| More than four ANC visits (Binary) | M14 Recoded |
| Received ANC (Binary) | S414 |
| Prenatal: ANM/Nurse/Midwife/LHV(Binary) | M2B |
| Prenatal: Doctor (Binary) | M2A |
| Received Nutrition Supplement (Binary) | S436 |
| Anaemia (Cat) | |

ISSN: 2455-8834

Volume:10, Issue:06 "June 2025"

## RESULT AND DISCUSSION

The NFHS-5 data reveals significant disparities in maternal healthcare access and birth outcomes across socio-demographic groups in a sample of 126,995 individuals. Rural populations (77.71%) dominate the dataset compared to urban residents (22.29%), with SC/ST (41.31%) and OBC (40.73%) castes representing the majority. Hindus comprise 78.06% of the sample, followed by Muslims (10.49%) and other religions (11.45%). Maternal education levels show concerning gaps, with 16.95% of mothers having no formal education and only 17.15% attaining higher education. Wealth disparities are evident, with the poorest and poorer quintiles together making up 44.36% of the population.

In terms of healthcare access, 63.35% of women received four or more ANC visits, while 36.65% did not meet this critical benchmark. Although 73.99% initiated ANC in the first trimester, 26% experienced delays. Skilled ANC coverage stands at 64.12%, leaving over a third (35.88%) without professional care during pregnancy. Low birth weight (LBW) affects 16.15% of births, signalling potential risks for infant health. The findings highlight systemic inequities, with rural, lower-caste, and economically disadvantaged groups facing the greatest barriers to adequate maternal healthcare.

The logistic regression analysis was carried in two parts- to study the association of prevalence of Low Birth Weight with socio-economic variable and with ANC variables. The results are shown in Table 2 and 3 respectively. From table 2 it is clearly seen that all of the socio-economic variables considered in the present study have turned out to be statistically significant in determining LBW incidence expect the place of residence. There is no substantial evidence (p value= 0.106) in our data that shows that there would be higher chances of LBW in rural area as compared to the urban areas. On the other hand, LBW incidence can easily be observed according to the social disparities across the population. The major difference is seen in the religion category, stating that with p value <0.001, as compared to Hindu population, Muslim (odds ratio= 0.846) population has 15 percent less chances of LBW children and further Christian and Sikhs (odds ratio= 0.619) have even lesser chances to experience LBW children. As far as the education is concerned, the level of education of mother is expected to bring better outcomes when a child's health is considered. Result from the logistic regression agrees with it although primary education (odds ratio= 1.023 and p value= .268) doesn't make any significant difference in LBW as compared to the mothers having no education at all. But as the level of education increases to higher the chances of LBW decreases 27 percent as compared to the women with no education. This result is an important indicator of the impact of education on the health of child as we can relate that educated mothers will be more aware about the childcare parameters and ANC provisions. Similar results have been seen in caste categories as well.

ISSN: 2455-8834

Volume:10, Issue:06 "June 2025"

Table 3 shows the results obtained after the application of logistics regression analysis between binary variable LBW and ANC and other biological variables namely, ANC visit in first trimester, 4 or more ANC visits, Prenatal: doctor, Prenatal: ANM/nurse/midwife/LHV, Anaemia level among women etc. Antenatal Care has proven to be an important factor in the incidence of Low Birth Weight among children. The analysis shows statistically significant difference between the reference category and other categories implying that ANC services improves the level of LBW among children. The women with low anaemia have 25 percent (odds ratio= 0.755) lesser odds of having LBW among their child. ANC visit in the first trimester (odds ratio= 0.925) decrease the odds of LBW whereas four or more ANC visits reduce these odds to 13 percent. The women who seek for ANC to one visit and then more have lesser chances of LBW among their children. The odds of LBW incidence are lesser when the woman visits a doctor rather then ANM/midwife/LHV.

The results from the two part logistic regression analysis show that the improved situation of LBW occurrence among children is affected largely by the socio-economic and ANC factors. With significantly low p- value, the analysis implies that improvement in the ANC can improve the situation of birth weight among children.

**Table:2 Outcome of logistic regression analysis between Low Birth Weight and socio-economic variables**

| | B | S.E. | Sig. | Exp(B) | 95% C.I. for Exp(B) | |
|---|---|---|---|---|---|---|
| | | | | | Lower | Upper |
| Type of place of residence<br><br>Reference Category (Urban) | | | | | | |
| Rural | .024 | .015 | .106 | 1.024 | .995 | 1.055 |
| Religion,<br><br>Reference Category (Hindu) | | | | | | |
| Muslim | -.167 | .017 | <.001** | .846 | .818 | .876 |
| Christian and Sikhs | -.480 | .023 | <.001** | .619 | .591 | .648 |

ISSN: 2455-8834

Volume:10, Issue:06 "June 2025"

| | | | | | | |
|---|---|---|---|---|---|---|
| Others | -.388 | .044 | <.001** | .679 | .623 | .739 |
| Highest educational level<br><br>Reference Category (No Education) | | | | | | |
| Primary | .022 | .020 | .268 | 1.023 | .983 | 1.064 |
| Secondary | -.106 | .016 | <.001** | .900 | .872 | .928 |
| Higher | -.312 | .023 | <.001** | .732 | .699 | .766 |
| Wealth Index<br><br>Reference Category ( Poorest) | | | | | | |
| Poor | -.076 | .017 | <.001** | .926 | .896 | .958 |
| Middle Class | -.114 | .018 | <.001** | .892 | .861 | .924 |
| Rich | -.187 | .019 | <.001** | .830 | .799 | .862 |
| Richest | -.175 | .021 | <.001** | .839 | .806 | .874 |
| Caste<br><br>Reference Category (Scheduled Caste) | | | | | | |
| Scheduled tribe | -.289 | .018 | <.001** | .749 | .723 | .777 |
| Other backward class | -.128 | .015 | <.001** | .880 | .854 | .907 |
| Don’t know the caste | -.145 | .019 | <.001** | .865 | .833 | .898 |
| Constant | -1.309 | .020 | <.001** | .270 | | |

**Note- **indicates highly significant values at 5% level of significance**

ISSN: 2455-8834

Volume:10, Issue:06 "June 2025"

**Table:3 Outcome of logistic regression analysis between Low Birth Weight and ANC Variables**

| | B | S.E. | Sig | Exp(B) | 95% C.I. for EXP(B) | |
|---|---|---|---|---|---|---|
| | | | | | Lower | Upper |
| Anaemia level<br>Reference Category (Severe) | | | | | | |
| Moderate | -0.17 | 0.045 | <.001** | 0.844 | 0.772 | 0.922 |
| Mild | -0.21 | 0.046 | <.001** | 0.81 | 0.741 | 0.886 |
| Low | -0.281 | 0.045 | <.001** | 0.755 | 0.692 | 0.825 |
| ANC visit in first trimester<br>Reference Category (No) | | | | | | |
| YES | -0.046 | 0.017 | 0.005 | 0.955 | 0.925 | 0.987 |
| 4 or more ANC visits<br>Reference Category (No) | | | | | | |
| (YES) | -0.105 | 0.015 | <.001** | 0.9 | 0.874 | 0.928 |
| Prenatal: doctor<br>Reference Category (No) | | | | | | |
| (YES) | -0.171 | 0.015 | <.001** | 0.843 | 0.818 | 0.869 |
| Prenatal: ANM/nurse/midwife/LHV<br>Reference Category (No) | | | | | | |
| (YES) | -0.084 | 0.015 | <.001** | 0.919 | 0.893 | 0.946 |

ISSN: 2455-8834

Volume:10, Issue:06 "June 2025"

| | | | | | | |
|---|---|---|---|---|---|---|
| Did you receive any supplementary nutrition from the Anganwadi centre during this pregnancy?<br><br>Reference Category (No) | | | | | | |
| (YES) | 0.029 | 0.016 | 0.073 | 1.029 | 0.997 | 1.062 |
| Constant | -1.151 | 0.049 | <.001** | 0.316 | | |

**Note- **indicates highly significant values at 5% level of significance**

## Conclusion

The present study has examined the association between mother's use of ANC services and LBW of most recent birth in the past five years preceding survey using latest round of NFHS data. In India, about one in six last birth under-five children (18%) are born with LBW in 2015–2016.

The findings of this study highlighted the importance of ANC services during pregnancy which has a significant impact on the incidence of LBW. Adequate utilization of ANC services was found to have significant negative association with LBW of children.

The results of our study suggest that providing affordable and quality ANC services among pregnant mother could be an effective path towards combat the incidence of LBW among under-five children. There were few noticeable points. Since, the percentage of total rural respondents was large (77.71), and even though the odds indicated that the prevalence of LBW is higher in rural areas, the results were not statistically significant. Though, we cannot ignore the fact that rural areas are less equipped with health facilities and do need more attention to reduce LBW among children. The percentage contribution of Hindu women was 78 percent and so it is expected that the incidence of LBW will be seen more in Hindu women. LBW is a serious public health problem in lower-middle income countries, associated with several adverse outcomes. Providing affordable and quality ANC services could be an effective strategy to reduce the incidence of LBW.

Furthermore, targeted intervention is needed especially among socioeconomically and demographically vulnerable women to improve the utilization of ANC services

**Availability of data:** The data are collected from the data repository of Demographic Health Survey (DHS) which is publicly available and could be assessed upon a request subject to non-profit and academic interest only (https://dhsprogram.com/data/available-datasets.cfm).

ISSN: 2455-8834

Volume:10, Issue:06 "June 2025"

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